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West Europe Report

SCIENCE AND TECHNOLOGY

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WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

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OVERVIEW OF MAJOR SWEDISH INSTITUTIONS IN POLYMER RESEARCH

Helsingborg PLASTFORUM SCANDINAVIA in Swedish No 10, 1984 pp 64-68

[Article by Per Rydgren]

[Text] Few countries in the world have as many engineers per capita as Sweden. Consequently we can maintain a high technological level in our industries and this is also true of the polymer industry, which has a very high quality on an international scale.

Another reason for our good position is access to technological assistance from institutes and institutions. Here we present six of our most important resources.

If we look back in time we can say that we Swedes have been better at training capable polymer specialists to meet the needs of the raw materials industry than in supplying the needs of polymer-consuming industries.

After all the biggest need for polymer experts is in the thousands of engineering firms, telecommunications and electronics apparatus firms, building materials firms and so forth, whose designers must create technically and economically optimal products that can compete on the world market.

Technical college and university officials have discovered the knack of constant "reprogramming" of the technical college courses. But the Board of Education is still passive when it comes to polymer education at the technical high school level. We in the branch consider that very unfortunate. High school engineering students are a very important group when it comes to technical innovation and they are largely left to their own devices with respect to learning about polymers.

But it must be said that the situation in Sweden is no worse than in other countries. On the contrary we are in a very good starting position here, since the number of engineers per capita is higher here than in most other countries. And technical curiosity is generally quite high, which provides a good foundation for innovation. The technical level in the Swedish polymer industry is very high in an international perspective. This is shown by the fact that West European major industries are glad to use Swedish plastic and

rubber companies as subcontractors. In spite of the handicap of long and expensive transportation our products are attractive to the continental auto industry, for example. Quality and guaranteed delivery are our most important sales arguments!

There are also some Swedish plastic and rubber companies that are among the best in the world in their own areas of specialization.

But there is more to learn. The Swedish polymer industry is backed up by a number of institutions and one institute, all of which promote development through education and research. Here we report on six of our leading technical college institutions that work with polymer materials along with the Technical Institute for Plastic and Rubber, PGI.

To avoid discussions of their respective quality, we are presenting them in geographical order, from north to south. All are well-equipped with machines and apparatus within their respective areas of activity.

Polymer Technology, Royal Technical College, KTH, Stockholm:
Professor Bengt Ranby, Professor Jan-Fredrik Jansson

This is Sweden's oldest polymer institution, founded in 1961. The institution belongs to the chemical section of KTH and deals with questions and projects involving polymer chemistry. The main theme in its 23 years of activity has been polymerization and its opposite, disintegration. An angle of the latter is the long-term properties of polymer materials.

The institution is the only one in Sweden that conducts research in rubber technology.

In recent years the institution has partially focused its work on polymerization with the help of photosensitive initiators, e.g. photopolymerization. The institution's expertise in this area is considered to be very high. Ultraviolet-treated paints and enamels are already being manufactured by Swedish paint factories.

Before Professor Ranby's retirement in 1985 KTH in conjunction with STU [Technical Development Board] is arranging an international symposium on photochemical polymer technology. The symposium will be held in Stockholm from 26 to 29 August 1985.

The following list of current research projects indicates the present scope of expertise in the field.

Modification of cellulose fibers through polymerization grafts.

Superabsorbant starch derivatives through polymerization grafts.

Phototempering of paints and enamels. Photo cross combinations of unsaturated polyesters without styrene.

Photovulcanization of rubber.

Photochemical modification of plastic surfaces.

Polymer photochemistry as a basis for photo-resist techniques. Photochemical stabilization of plastic and rubber.

Accelerated environmental exposure of polymer material.

Formation, structure and properties of the oxygen polymer complex.

Biological and physical disintegration of building materials. Biomedical polymers.

Polymer stabilizers for polymer materials.

The disintegration of polymers in an electrical field.

Semicrystalline polymers.

Polymer fiber composites. Fracture initiation under long-term stress.

Long-term mechano-chemical stability in polymer materials. Morphology and properties of polyethylene. Fracture initiation in brittle surface layers. Physical modification of polymer materials. Thermo-mechanical modification of vitreous polymers.

Ultraoriented polymer fibers.

Vibrorelaxation in rubber materials. Modular changes in rubber materials during aging. Rubber-metal bonds. Dielectrical properties of rubber during vulcanization. Application of computer tomography to polymer materials.

Light Constructions, Royal Technical College, KTH, Stockholm:
Professor Jan Backlund

This institution used to be called "Airplane Statics," but since that name undeniably leads one's thoughts in a definite direction, the name was changed to "Light Constructions."

The institution does extensive work with polymer fiber composites. This is an area that still requires big research and development investments when it comes to dimensions and manufacturing methods. The anisotropic nature of composite materials makes it difficult to analyze the strength around holes and indentations, but Backlund's institution has acquired great competence in this area. They also have acquired a lot of knowledge in calculating techniques for sandwich constructions.

The institution is involved in sandwich applications to minesweepers, satellites, milk trucks, balconies, doors, railroad cars, house elements, etc.

Research projects: Polymer fiber composites--calculation of static fractures in both long and short-fibered composites. Relationship between material properties and design strength. Calculation methods for polymer-based sandwich constructions (basis for CAD [computer assisted design] calculations). Optimizing composite constructions (automatic selection of fiber direction, thickness and geometry).

Polymer Technology, Chalmers Technical College, CTH, Goteborg:
Professor Per Flodin

This is an institution within the chemistry section of Chalmers. The institution's emphasis lies on chemical characterizing of polymers. A great deal is known here about GPC (gelchromatography), which is used among other things for determining molecular weight distribution in polymers. The GPC laboratory is one of the most well-equipped in Europe. Work is also done on nuclear magnetic resonance (NMR), which is so precise that a single different carbon atom can be detected among 10,000 other carbon atoms.

A major part of the institution's assignments fall to the "Polymer Group," led by Erling Sorvik, Licentiate in Technology. The polymer group has worked a lot on assignments concerning the development of ethylene and PVC plastics.

Below are the institution's current research projects:

Aromate-based high module polymers (aramide fibers). Tempering mechanisms. Surface modification of cellulose fibers. Interpenetrating networks. Mechanisms for gel formation.

Hydrophile gels. Matrix-bound reagents. Adhesion between ethylene polymers and metal surfaces.

The effect of metallic catalysts on polyethylene's thermal stability. Modification through graft polymerization. Structural defects in PVC. PVC with improved thermal stability. Thermal stabilizers' reaction with PVC. Pressure polymerization of vinyl chloride. Continual polymerization of vinyl chloride. PVC net formation. Dye master batches. GPC analysis of polymers. Polymer characterizing with NMR.

Polymer Materials, Chalmers Technical College, CTH, Goteborg:
Professor Josef Kubat

If one is to give this institution any labels they would be "form casting" and "compounding." Thus this is the Swedish institution where the emphasis is closest to the needs of plastic processors. Kubat's institution belongs to the mechanical section of Chalmers.

The institution knows a lot about molecular and fiber orientation as well as inner tensions in molded plastic products. This includes a solid body of knowledge about the connection between process variables and quality parameters in thermoplastics.

Another area of expertise is the physical aging of plastics, which is not the same as chemical aging. Physical aging means that with time the molecules arrange themselves and form a denser structure. This has a negative effect on impact resistance, among other things.

In other words the institution can explain a number of contexts that affect the technical quality of plastic parts. These areas of expertise are described in reports that can be ordered from PGI (Tel: 08-7445100).

Current projects:

Mechanical properties of polymer materials. Description of shrinkage and relaxation processes. Polymer alloys. The effect of aging on mechanical properties. New material combinations (compounds). Electricity-conducting plastic. Usable plastic from waste products. Heat-conducting fillers for plastic. Fluid properties of filled polymer blends. High-pressure molding. Orientation saturation with FIR [expansion unknown] laser.

Technical Institute for Rubber and Plastic, PGI, Stockholm, Varnamo, Sundsvall:
Director: Goran Malhammar

A recently presented report from FRN (Research Council Board) stated that in general there is a wide gap between academic research at our universities and colleges and the consumers of this research, e.g. the private business sector in the form of industries, administrators and public bodies.

Thus intermediate links are needed. The report mentions a particularly important link, branch institutes. When it comes to the polymer area there is such a branch institute, the Technical Institute for Rubber and Plastic, PGI.

The goal of PGI's organization is to maintain competence along the entire chain of material selection, construction and production. There are two areas of activity, branchwide research and development and consultant activity.

Research and development projects under PGI are all connected with member firms. Member firms are those firms that belong to the Plastic and Rubber Technology Foundation, PGS (which owns PGI together with STU).

At the moment some 30 projects are under way that can in principle be assigned to "construction and calculation" and "production techniques." One project is described elsewhere in this issue of PLASTFORUM, "Product Property Control of Molded Thermoplastic Products" [not included].

Another current research and development area is the deterioration of rubber materials in water, hot air and oil. The testing time here is 5 years. A further project concerns threshold value studies of fatigue limits for plastic and rubber.

A comprehensive effort that began around 3 years ago and will continue until 1986 is the production of design handbooks in the areas of rubber,

thermoplastics and AP [expansion unknown]. The first is being issued in cooperation with the Mechanics' League and will be on the shelves of bookstores by the beginning of 1985. The thermoplastics handbook is being given a final revision at this time and will be issued in the spring of 1985.

A great many of the inquiries that are sent in to PGI concern the selection of materials. A computer bank is being built up to simplify the choice of materials. This includes other materials besides plastic. PGI is working with technical colleges in Linkoping, Goteborg and Stockholm on this project. The goal of the computer bank is to set it up for use by designers as well as material technicians and buyers.

One project in the production techniques group is called "Simplified Product Control in Slip Casting." A study is being made as to whether there is a connection between the inner pressure of the mold, mold temperature, temperature of the mass, the speed of slip injection, the number of revolutions, stress, product size as a measurement (weight) and measurement distribution. As the project continues an effort will be made to see if it is possible to correlate process parameters with strength, impact resistance, etc.

Another slip casting project is "Optimizing Rubber Slip Casting," which was described in the last issue of PLASTFORUM. Another project is "Production of Unflawed Rubber Products."

When a project has been initiated by one or more member firms PGI determines where the expertise can be found for that particular project. Often a task force is formed that is directly responsible for carrying out the project.

At times a project is assigned to a firm or a technical college. PGI is a practical meeting place for academic people and industrial technicians.

PGI is also active in the areas that are supported by STU with 11 million kronor going to polymer-based fiber composites and 35 million kronor to polymer-based construction materials, for example. But a good deal of this work is done at the technical colleges.

Chemical Center's Polymer Group, Technical College in Lund, LTH:
Professor Bertil Tornell

The Lund Chemical Center is northern Europe's biggest chemical research unit. There are close to 1000 students and around 200 of them are students at the doctoral level.

Polymers are found here and there in this enormous institution. But the polymers that interest the readers of this magazine come primarily under Professor Bertil Tornell's polymer group.

"Surface Properties of Polymer Materials" is a label one could attach to Tornell's group. And this means microscopic "surfaces," in other words particle surfaces. These are studied with advanced eléctron microscopes and the goal is often to adjust fillers and reinforcement materials to plastics.

Another of Tornell's specialties is the measurement of properties with the help of an automatic torsion pendulum that operates at temperatures between -150 and +300°. With the help of this one can study distortion modules and loss factors as functions of temperature. Very interesting things when one is experimenting with various additions to polymers (phase separation).

Current projects:

Emulsion polymerization. New initiator systems for free radical polymerization. Particle formation in M and S [expansion unknown] polymerization of PVC. Cross binding films from polymer solutions. Fractures in rigid PVC. Tempered plastic with improved impact resistance. Surface-active polymers. Studies of synthetic pentaerytritol.

6578
CSO: 3698/183

ADVANCED MATERIALS

FRG: INCREASED CERAMICS RESEARCH AT MAX PLANCK INSTITUTE

Duesseldorf HANDELSBLATT in German 14 Nov 84 p 19

[Text] HANDELSBLATT, Tuesday, 13 Nov 1984, gh Stuttgart. For the promotion of structural change in technology in Baden-Wuerttemberg, the land government approved special financing in the amount of DM 6 million for expansion of ceramics research at the Max Planck Institute for Metals Research--Institute for Materials Science--in Stuttgart. The money has to be raised within the confines of the present budget proposal by deleting other items. For expansion construction and for establishment of a project group--for which the Max Planck Society will have no funds in the foreseeable future--funds have been provided from the business financing grants, announced State Secretary Matthias Kleinert. This "joint subsidy" applies to a key technology. The cabinet agreed to the subsidy since with the research work in the field of ceramics a far reaching development is starting in a materials field that will become a prerequisite for future technical and economic capability. At the University of Karlsruhe a "Ceramics Design Center" will be established. Both initiatives are derivatives of recommendations of the research commission. The Baden-Wuerttemberg industrial exhibition planned for Moscow in March 1985 by the export promotion commission is drawing greater than expected interest, according to Kleinert. To date, 125 companies have registered. Instead of the planned DM 5 million for the 10,000 square meter space in Moscow's Sokolniki Park, the land government will have to raise DM 6.5 million. The exhibition is regarded as an important building block for furthering the export activity of medium sized companies.

9160
CSO: 3698/120

AUTOMOBILE INDUSTRY

VW'S NEW EXPERIMENTAL CAR DESCRIBED

Turin ATA-INGEGNERIA AUTOMOTORISTICA in Italian Aug-Sep 84 p 511

[Text] With the IRVW (Integrated Research Volkswagen) Volkswagen continues the series of research vehicles begun in the early 1970's with the ESVW1. The work on the IRVW, for both stylistic and technical purposes, is aimed at combining in an integrated concept many very important individual solutions ranging from cost to utility, from high performance to better active security, from comfort to better fuel efficiency, and finally, and no less important, meeting pollution standards.

Among the specific solutions applied are an injection engine of 1,800 cc that delivers, thanks to a light alloy mechanical compressor, power of 132 kW (180 h.p.) at 5,500 revolutions per minute, which enables it to reach a maximum speed of 212 kilometers per hour and acceleration from 0 to 100 km/hr in 7.4 seconds. The chassis, which is designed for improved comfort and security, has a pneumatic suspension that enables lowering the vehicle at high speed, improving the aerodynamics and thus also the economy (at over 120 km/hr the chassis lowers to 40 millimeters, then at 90 km/hr resumes the normal trim).

A skid control (ASR) enables the vehicle to continue without problems when the friction degree of the roadway is very reduced (for example on ice) or when it is different on the two sides. A microcomputer compares the acceleration of rotation of the drive wheels with the acceleration of the vehicle; the "exceeding point" that this detects and that causes the slipping of the wheels is eliminated through a system that can be described as blocking the differential. The wheel slipping is prevented with optimum results on ice, in the case of "aquaplaning," and when there is a different degree of roadway friction, when the ASR cuts engine power by automatically reducing the throttle and also reducing the driving power of each wheel, depending on the driving condition, by automatic braking. Finally, an automatic anti-siezing system ensures constant and safer braking.

A servo-steering, whose effect depends on the speed, improves driving comfort. With the car stopped or moving slowly, the steering is extremely light; with increase in speed the servo-assistance effect is reduced and the driver gains more direct feel of the road.

The internal equipment provides numerous interesting solutions. The leather sport seats are electrically adjustable; the doors are automatically locked when the ignition key is turned, and for reopening have centralized lock; an

electronic navigator ("Navicomp") provides useful information to the driver; the radio is operated by controls on the steering wheel; a liquid crystal display fulfills the role of the traditional instruments; and finally, an ingenious system of seat belts significantly improves the security of the passengers (Volkswagen notice 2/4--1984).

9920
CSO: 3698/181

BIOTECHNOLOGY

ITALY SURVEYS SECTOR, ISSUES REPORT

Paris BIOFUTUR in French Sep 84 p 72.

[Text] The report on "Biotechnologies in Italy" prepared by the Federation of Scientific and Technical Associations (FAST) in Milan, was drawn up by a research group charged with surveying 142 operational units.* Who does what in Italy in the field of biotechnology? What is the participation of the public institutions (universities, institutes, CNR [National Council on Research] centers and that of the industries or private institutions?

The first object of tbis report is to clarify this matter by setting up an actual "catalog" in which research groups are listed by field of interest. Such a catalog will be useful for the economic and scientific decisionmakers, and will provide statistical data similar to what has been done in other countries, which will give some idea of the place occupied by Italy in international biotechnological competition.

Another aim of the report: to evaluate the impact of biotechnologies on the industrial production process by analyzing the present or future achievements of other countries. Such a study will be of help in evaluating the role of biotechnologies in Italy's economic future.

Many Italian laboratories have an excellent level of skill. But without a clear view of the industrial implications of the new techniques, their skills would tend to remain in the academic field: the report aims to stimulate relations between public and industrial research. The survey dealing with operational units has been limited to certain sectors, chosen among the most promising: recombinant DNA, Hybridomes, culture and fusion of cells, immobilization of bio-molecules, chemistry of proteins, chemistry of trace-nucleotids. This choice seems to exclude other biotechnologies such as fementations (used for example for biomass valorization or to produce therapeutical molecules), techniques which are already widely used in Italian industry but which will be strongly influenced in the near future by the latest techniques, which were of principal interest to this report.

During the last few years, these six advanced technologies, the main object of the study, have indeed opened up new perspectives in research and industrial

*This report completed under the auspices of Milan Popular Bank, Caboro, Montedison, Pierrel, CNR (National Research Council).

production which would have been called a futuristic ten years ago. By their interaction, they will form a unique technological heritage. The various specialists of the fields concerned tend more and more to collaborate with each other and in this way we see a close-knit body of skills taking shape which are indispensable for developing research in basic and applied biology.

The FAST - which some years ago formed a Permanent Biotechnological Committee - fells that the report which it drew up will contribute to industrial development in a sector which could turn out to be of strategic importance for Italy's economic future. By proposing this report, it remains faithful to its mission, that of promoting cooperation between university and industrial research centers, and contributing to the development of a technological sector which will be decisive for the bio-society of the year 2000.

It should be added that the FAST plans to organize congresses and specialized exhibitions in this field, under the auspices of the Permanent Biotechnological Committee.

12687
CSO: 3968/160

BIOTECHNOLOGY

FRANCE ORGANIZES SECOND INTERNATIONAL EXPOSITION

Paris LA LETTRE DES BIOTECHNOLOGIES in French Nov 84 p 12

[Text] Only three months following the decision of the Meurthe-and-Moselle CCI [Chamber of Commerce and Industry] to organize for next year the Second International Meeting of bio-industries, "BIO + 85" and one year before the event, lecturere, industrialists, exhibitors from all over France, and even from abroad, have already indicated their intention to attend BIO + 85.

It is true that the new biotechnologies are arousing a growing interest. For example, in Lorraine, since 1982, the date of the first such meeting, the number of firms using the new biotechnologies or having launched research programs has more than doubled.

From fewer than 20 in 1982, the "Industry" service of the Meurthe-and-Moselle CCI has counted more than 40 this year, not counting projects in the planning stage.

The main sectors of application are: agriculture, agro-chemistry, food, health, energy.

The biotechnologies apply also to other sectors such as boilermaking or equipment instrumentations.

The purpose of the "BIO + 85" meetings, which are slated to be among the most important in Europe, is to make the PMI-PME [Small and Medium Business and Industries] aware of these new technologies and to make of Lorraine a "driving force" in the matter of bio-industries.

"BIO+EXPO 85": A Professional Exhibition Exclusively Devoted to Biotechnologies As They Apply To Research, Industry and Agriculture (4 - 8 June, 1985 - PARIS).

Following the great success of "BIO-EXPO 83" it became imperative to conceive of the second edition of this event as a professional exhibition devoted to biotechnologies on an international scale.

To this end, the Pasteur Institute's Development Association joined forces with BIOFUTUR and the firm SEPFI to set up "BIO-EXPO 85" whose organizing

committee is under the leadership of Professors Raymond Dedonder, Director of the Pasteur Institute, Pierre Douzou, Vice President of the Launching Program "Growth of Biotechnologies" and Francois Gros, Professor at the College De France. "BIO-EXPO 85" is furthermore, under the auspices of the Ministries of Agriculture, of Industrial Redeployment and Foreign Trade, and of Research and Technology.

This exhibition will be held from 4 to 8 June, 1985, in Paris (Porte de Versailles).

A program of lectures on biotechnologies will accompany the exhibition, this program being carefully worked out by leading specialists in the field.

12687
CSO: 3698/160

BIOTECHNOLOGY

FRANCE'S INRA CHIEF SUGGESTS INDUSTRIAL STRATEGY

Paris BIOFUTUR in French Nov 84 pp 43-49

[Article by Pierre Feillet, research director, National Agronomic Institute (France) and head of Department of Proteins and Carbohydrates]

[Text] Will biotechnology stir up exchanges between industrial sectors (food, chemistry, health, and energy) that are now independent? This article opens the debate.

The majority of forecasting professionals (government agencies and consultants) are announcing exponential growth of the biotech products market. For example, the T. A. Sheets Company expects shortly to be reaching $27 billion while the U.S. Office of Technological Assessment believes the market will be $15 billion at the dawn of the twenty-first century. These studies predict that numerous wholly-new products such as vaccines, hormones, microorganisms, seed, etc., will be placed on the market.

Most of these studies are on just one industrial sector (food, chemistry, health, and energy) or even on very specific products (sweeteners, food additives, seed, biopesticides, etc.). The likelihood of biotechnology "stirring up" exchanges between industrial sectors has scarcely been examined. It could, however, end up being one of the most important effects of biotechnology. This is the thesis developed in this article, whose purpose is to open a debate on some of the following questions:

--will biotechnology reshuffle the cards between agriculture, the food industry, the chemical industry, and the energy industry?

--will biotechnology be at the origin of substantial competition between fossil-based energies (oil, coal, and gas) and renewable biomass?

--will such competition also become established between farm products such as wheat, corn, beets, sugarcane, and milk?

--will biotechnology start changing the relationships, now very close and specific, between agriculture and the food industry?

Some light can be thrown on these questions by looking at three specific sectors: sweeteners, protein sources, and various ways of making organic and biological molecules.

The World of Sweeteners

Sweeteners belong to very different chemical families. Some of them, of natural origin, are extracted directly from sugar beet or sugarcane (saccharose); others are obtained from starch (fructose and sorbitol); others again are synthetic (aspartam and cyclamate) (Table 1). The majority of them are not just sweeteners; they are also energy foods and preservatives and texturizers.

Up to 1975, the sweetener market was dominated by saccharose extracted from sugar beet or sugarcane; the recent development of high-fructose corn syrups (HFCS)(1) has been steadily changing these industries. HFCS is made from cornstarch but wheat, sorghum, and manioc are also potential sources of starch for these industries.

In the United States and Japan, HFCS represented over 30 percent of the sweetener market in 1983(2). In Europe, EEC policies restricted its development while in the U.S. three factors favored its takeoff: the high sweetening power of fructose which provides fewer calories than glucose or saccharose while its sweetening effect is the same; the American saccharose deficit and this country's interest in controlling its sweetener production; the economic advantages of the process.

The net cost of cornstarch (CNAM) depends on the cost of corn and starch coproducts (oil, proteins, and glutenfeed). CNAM, and hence the price of fructose, is very sensitive to the price of glutenfeed. It is considered that CNAM was 54 percent dependent on the price of corn in 1976 and only 41 percent in 1980.

The search for new glutenfeed outlets has paralleled the development of the fructose industry. Although it is somewhat unfavorable to the development of the HFCS industry, Europe opened up to American glutenfeed (0.7 and 3 million tons, of which 89 percent and 96 percent were of American origin, were imported in 1974 and 1981 respectively) and hence directly supported the development of the U.S. HFCS industry.

HFCS manufacture is an example of the potential influence of biotechnologies on the use of agricultural resources. It threatens the sugarcane and sugar

(1) HFCS is the result of four main operations: extraction of starch; enzymatic hydrolysis of starch into glucose by alpha-amylase and glucamylase; isomerization of glucose into fructose by glucose isomerase; separation of fructose and glucose. This technology was developed over the last 25 years starting from the discovery of xylose isomerase in 1957 and its purification.

(2) A Canadian statistic breaks down the HFCS penetration levels as follows: beverages 70 percent, baking products 20-30 percent, processed foods 25-30 percent, canned goods 40 percent, dairy products 20 percent, sugar refineries 5 percent.

beet industry and opens up competition between corn, wheat, and manioc on the one hand and sugar beet and sugarcane on the other hand. As R. Crott has said, the "right response of the sugarcane and sugar beet industry is not to develop protectionist strategies but to commit to an "aggressive" research and development program with the object of increasing the use of sugar as a substrate for the chemical industry and find a high added-value for these raw materials.

There is also competition between the various sources of starch. Because of the higher value of its co-products (mainly gluten), wheat must be considered a particularly competitive substrate, particularly in France and Australia. Moreover, the possible development of the Jerusalem artichoke in France under the carburol program could, if successful, put a new source of fructose on the market.

Because of the development of enzyme technologies and fermentation industries, competition is opening up between cereals, sugarcane and sugar beet, and perhaps the Jerusalem artichoke to produce sweeteners, alcohols, and chemicals.

Protein Resources

According to G. Fauconneau, 180 million tons of protein are produced every year from cereals, protein-containing, and oleaginous products and 200 million tons from fodder and its derivatives. Of these 380 million tons, 300 are converted by cattle into animal protein (with an average yield of 12 percent). There remain, for human beings, 80 million tons of plant protein (cereals and legumes) and 35 million tons of animal protein (excluding fish). Our food protein resources would be sufficient if animals did not consume directly usable plant proteins. But this state of affairs will continue as long as people favor animal proteins.

Since the 70's, it has been hoped that proteins from unicellular organisms would bridge the protein gap. If used for feeding domestic animals, they would free up more plant proteins for human needs. Various raw materials have been used to make unicellular animal proteins: paraffin, methanol, plant waste, lignocellulose materials, lactoserum, and cereal starch. The production of unicellular animal proteins from easily accessible dairy industry by-products has been fully worked out. The British chemical company ICI built a factory able to turn out 60,000 tons of unicellular animal proteins per year from methanol. Proteins have been successfully made from lignocellulose materials, but much remains to be done in cutting the cost of the processes developed. However, yeast proteins are made today in the Soviet Union after acid hydrolysis of wood. One may wonder, however, whether rennin is the best fermenting agent for producing protein from lignocellulose.

Finally, 500,000 tons of unicellular animal proteins are produced every year, i.e. only 0.10 to 0.15 percent of the world's agricultural protein production. The main obstacles to the development of unicellular animal proteins are economic and psychological. Soy continues to dominate the world protein market. Only if firm policies are implemented will certain countries be able significantly to increase their unicellular animal proteins production and thus gain protein independence. Although certain oil- and gas-producing countries seem

to have such firm policies (witness the symposium held in Algiers at the end of 1983), the unfortunate experiment of British Petroleum in making unicellular animal proteins from n.paraffin discouraged many industrialists.

However, some countries and some chemical and oil companies, e.g. Hoechst and Philips Petroleum, are persevering in their research and development programs in this field. In the long term, the world's stock of proteins could be influenced. Methanol seems to be one of the raw materials of choice.

Another Method of Producing Chemical and Biochemical Products

Whether or not biotechnologies are used for producing chemicals from biomass (starch, saccharose, and cellulose) at the expense of petrochemicals and carbochemicals depends on many factors, of which the main ones are:

--the value of the "renewable fermentable carbon" by comparison with the cost of fossil resources;

--scientific and technical progress in genetics, microbiology, fermentation processes, and extraction and purification technology;

--the nature of the chemicals involved.

Let us look at the third point, remembering that the raw materials represent 50 to 70 percent of the cost of chemical products with a low and medium added value, obtained by fermentation.

As summarized in Figure 3, potential competition between bioindustries and chemical industries relates particularly to oxygen compounds, shown in Table 2. The biomass route to ethylene, via alcohol fermentation, will not be open in the foreseeable future. On the other hand, highly complex macromolecules--proteins, enzymes, vaccines, antibiotics, and glucide polymers--cannot be synthesized chemically; they can only be obtained by biological processes.

Manufacture of ethanol by fermentation is competitive with chemical synthesis from oil. This does not mean that the ethanol thus obtained is competitive with the oil and gas used as fuels. The usable raw materials are wheat, corn, sweet sorghum, sugarcane, beets, and manioc. Acetic acid is made by the chemical industry or by fermentation, depending on whether its end use is industry or food. Manufacture of the acetone/butanol mixture was an important activity before World War II; at present, only South Africa continues to manufacture it in this way. Research and development programs are under way, particularly in France, for making this manufacturing process more competitive. Most amino acids are made by fermentation with the exception of methionine and, partly, lysine.

Depending on their degree of polymerization, peptides are made biologically (over 30 amino acids), chemically (less than 10 to 15 amino acids), or by either technology (10 to 30 amino acids).

The quantities of agricultural biomass and lignocellulose materials (forestry waste and products) available are considerable (Table 3); progress in genetics and agronomy leads to the hope that arable areas can be increased and crop yields improved.

In its last report (march 1984), the U.S. Office of Technological Assessment estimated that 14 percent of U.S. corn production (about 270 million tons) could by 1990 meet all the chemical industry's substrate needs without cutting into the resources required for other traditional uses (food and animal feed industries, export market, alcohol, and seed).

The main restrictions on the use of agricultural biomass by the chemical industry are technical (water content of biomass, low concentration of products obtained by fermentation, cost of extraction and purification) or economic.

In Europe, the current joint agricultural policy is considered to be a very powerful obstacle in the way of developing manufacture of chemicals by fermentation by reason of the price mechanisms in place; although European industry can be competitive on the world market, the complex price-fixing mechanisms make it disadvantageous at home. The EEC persists in believing that the only customers for farm products are the agricultural and food industries.

Many Forms of Competition in Prospect

Figure 4, which represents our conclusions in summary form, shows the many forms of competition that could be established on the one hand between fossil sources (oil gas, and coal) and renewable sources, and on the other hand between the renewable sources themselves (cereals, tubers, beet, sugarcane, Jerusalem artichokes, soy, milk, and lignocellulose products) to serve as substrates for the fermentation industries. These would lead to production of:

--energy products: methane, ethanol, butanol, and vegetable oils;

--chemicals such as organic acids, alcohols, and solvents;

--fine chemical products and biological products such as peptides and amino acids;

--food and animal feed products such as sweeteners, lipids, and proteins.

In the medium term, the interaction between raw materials (fossil coal and biomass) and finished products made by energy, chemical, pharmaceutical, and food and feed industries can contribute to the diversification of the industrial partners of agriculture, thus weakening the close, one-for-one relationships between farming and the food and animal feed industries, and changing EEC policy on the prices of agricultural raw materials that can be converted by fermentation into chemicals under the pressure of new parterns for agriculture.

In addition, the fact that the research capability of commercial companies whose only activity is food is very small by comparison with that of the chemical, pharmaceutical, and energy industries (the majority of which are

making giant research efforts in molecular biology, genetic engineering, enzyme engineering, genetics, microbiological, and fermentation engineering) leads to questions about the ability of the food industry to retain control over its own sector of activity. If the scheme laid out in this article is correct, the only chance major companies engaged in food only will have is to diversify to remain competitive.

Biotechnology--A Powerful Link

Biotechnologies are considered to be a bridge between scientific or technological disciplines (genetics, enzymology, electronics, biochemicals, microbiology, etc.) and numerous chemical products (citric acids, amino acids, interferons, cheese, etc.) They must also be considered to be a powerful link between fossil and renewable raw materials (oil, gas, cereals, milk, etc.) and food, chemical, and energy industries.

Table 3: World Production of Biomass (millions of tons)

	CEE	World
Cereals		1,660
Corn	125	450
Sugar beet (in nonrefined sugar)	102	280
Sugarcane (in nonrefined sugar)	-	780
Potatoes	34	260
Manioc	-	130
Soy	-	90
Other protein plants	1	40
Peanuts, rapeseed, sunflower	2.5	45
Milk	120	470

Source: FAO, 1981

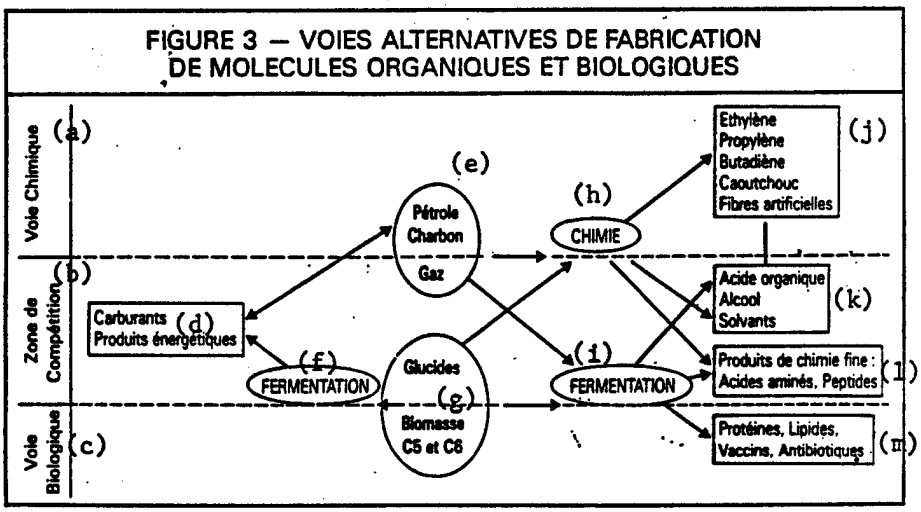

Figure 3: Alternative Methods for Producing Organic and Biological Molecules

Key:

a. Chemical method
b. Zone of competition
c. Biological method
d. Fuels
energy products
e. Oil Coal Gas
f. Fermentation
g. Glucides Biomass C5 and C6
h. Chemistry
i. Fermentation
j. Ethylene Propylene Butadiene
Rubber Synthetic fibers
k. Organic acid Alcohol Solvents
l. Fine chemicals: amino acids,
peptides
m. Proteins, lipids, vaccines, anti-
biotics

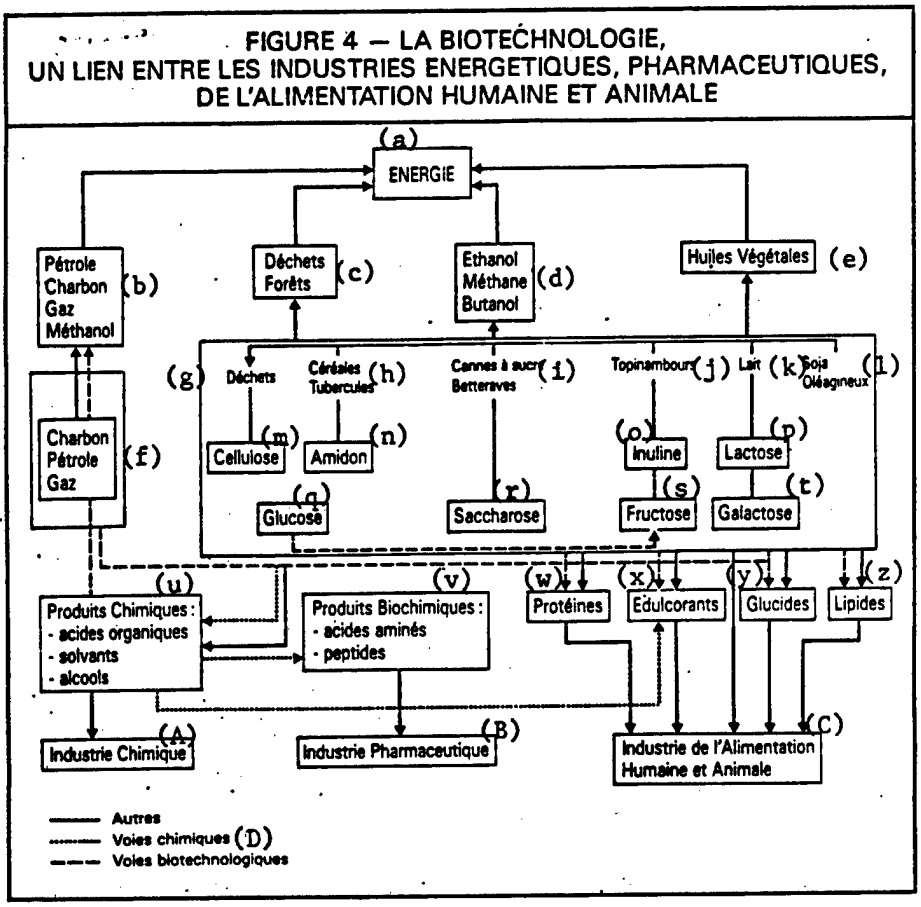

Figure 4: Biotechnology, a Link Between Energy, Pharmaceutical, Food, and Animal Feed Industries

Key:

a. energy
b. Oil Coal Gas Methanol
c. Forestry waste
d. Ethanol Methane Butanol
e. Vegetable oils
f. Coal Oil Gas
g. Waste
h. Cereals tubers
i. Sugarcane Sugar beet
j. Jerusalem artichokes
k. Milk
l. Oleaginous soybeans
m. Cellulose
n. Starch
o. Inulin
p. Lactose
q. Glucose
r. Saccharose
s. Fructose
t. Galactose
u. Chemicals: --organic acids - solvents - alcohols
v. Biochemicals: --amino acids - peptides
w. Proteins
x. Sweeteners
y. Glucides
z. Lipids
A. Chemical Industry
B. Pharmaceutical Industry
C. Food and Animal Feed Industry
D. Other
Chemical methods
Biotechnological methods

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BIOTECHNOLOGY

INDUSTRY-UNIVERSITY BIOMEDICAL RESEARCH LABORATORY

Rome L'UNITA in Italian 4 Dec 84 p 10

/Text/ Yesterday in Basel the protocol of the founding of the "Milan molecular pharmacology laboratory" (MPL) was signed by Roche in the presence of the minister of research, Luigi Granelli, and the rector of the state university of Milan, Paolo Mantegazza. A new laboratory of biomedical research has thus been created in the leading sectors of molecular biology and genetic engineering, characterized by a highly-innovative contractual arrangement between an industrial firm and the university of Milan. The MPL will fall within the national scientific network, as it will be inserted in the finalized project of the CNR /National Research Council/ entitled "Fine Chemistry."

The new laboratory which will start up operations by the end of January, will have its headquarters at Roche, Milan, but will maintain very close links with the other Roche centers in the world, especially with the "Roche Institute of Molecular Biology" in the United States, and with the "Basel Institute for immunology" where professors Jerne and Koehler completed their research; two of the three scientists awarded the Nobel prize for medicine this year. Thus Roche intends to assure itself of a "window" or observation point of everything new in the Italian biomedical research environment, which it considers equipped with highly-skilled researchers. This is evidenced by MPL's employment of six to eight researchers from the pharmacological institute of the University of Milan, anticipating investments set at 1.6 million in 3 years.

Molecular biology and genetic engineering are the fields in which the industry expects major developments, such as in immunology, to obtain drugs more closely related to the elements which constitute the natural defenses of the body. These expectations explain the choices made by Roche for the new molecular biology laboratory, which will be coordinated overall by the vice director of the Italian Roche, Alessandro Ovi. The MPL will specialize in a sector of neurobiology which concerns the role of sexual hormones in the central nervous system. In fact it has been discovered, and there is clinical evidence, that some sexual hormones are involved in manifestations of depression, emotional disorders and epilepsy. It is hoped, consequently, that our understanding of the way in which hormones "modulate" the nervous functions, in areas of the central nervous system as well not directly related to the regulation of endocrine functions, will be impoved.

An attempt will be made to start with modifications, at the level of the genes produced in some areas of the central nervous system, utilizing, with the help of viruses and bacteria, techniques peculiar to gneetic engineering. This is the new approach which will characterize, over the first 3 years, the MPL project, which will consult with an international scientific committee. The research group will be directed by Adriana Maggi of the University of Milan, who returned a short time ago to Italy after a 5-year stay at one of the most advanced centers in this field, in Houston.

Her "return" is already an expression of the policy which Roche intends to follow: to bring researchers to the new laboratory who are presently abroad. However it is worth while emphasizing the innovative character of this undertaking from the organizational and instutitional point of view, and the opportunity it offers for research and scientific exchange between university and industry, which are quite unique in the present Italian scientific community, and it is not only Italian. The 3-year agreement signed with the university of Milan, aside from considerations such as the exchange of researchers, seminars and scholarships, is in fact the first agreement which provides for the implementation of research projects proposed by the university and considered by Roche to be useful for its own purposes.

The scientific and academic world and the industrial world are two realities in Italy, with very little interconnections. The MPL is without doubt an encouraging step since a closer link has been forged between the knowledge obtained from basic research, the innovations which are the goal of applied research and the developments which come from the transfer of such research to the industrial level.

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BIOTECHNOLOGY

BRIEFS

SPANISH CENTER--Spain will set up its own national center of research in genetic engineering and biotechnology. The government will fund the center to the tune of $18 million for the next 3 years. The center will be located in the University of Madrid and will employ some 250 people. This decision was made following the proposals last year by UNIDO [United Nations Industrial Development Organization] to create an International Center of Biotechnology in Italy and in India, but not in Spain as had earlier been suggested. (Source: SCRIP 29 Aug 84, 3 Sep 84) [Text] [Paris BIOFUTUR in French Nov 84 p 15] 12687

CANADIAN STRATEGY--The Canadian government has allocated $11 million annually for the next two years to develop a national strategy. The long term goal of this strategy is to set up regulations and programs which will enhance scientific research and its industrial applications. In this way, research and development networks are established in the fields affecting Canadian industry. Each network system is administered by a scientific department consisting of members from the government, the university, industry and others directly from the sector involved. Research-industry interaction (technology transfer, sharing and exchanging of personnel and equipment) and international scientific collaboration will be encouraged. Lastly, a National Biotechnology Advisory Committee has been set up. It will have an advisory role. The four networks are to be concerned with: Animal and human health products (National Health and Welfare, Dr Keith Bailey, 993-5732). Use of cellulose and treatment of wastes (National Research Council, Dr John Vose, 993-1790). Lixiviation of metals (Energy, Mines and Resources, Dr Michael Campbell, 996-2929). Fixation of nitrogen and development of vegetal lineage (Agriculture Canada, Dr Ian de la Roche, 995-3700). [Text] [Paris BIOFUTUR in French Sep 84 p 15] 12687

ISRAEL'S INTER YEDA MARKETS INTERFERON--The pharmaceutical firm INTER YEDA which works in close collatoration with the WEIZMANN Institute of Sciences, has recently released the first drug containing beta interferon produced from human fibroblasts: Prone. This drug, at first authorized on a trial basis in the form of a cream for treating diseases such as genital or facial herpes, chickenpox, etc., is now authorized in the form of intra-muscular injections, and as eye drops. It is about to be commercially distributed

in Israel. The product can be obtained already by prescription in Italy and in Argentina. INTER YEDA is a branch of YEAD [as published] RESEARCH AND DEVELOPMENT which holds the commercial rights awarded by the WEIZMANN Institute. There are some twenty or so private firms in Israel today, which are involved partially or wholly in biotechnology. [Text] [Paris BIO LA LETTRE DES BIOTECHNOLOGIES in French Nov 84 p 12] 12687

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CIVIL AVIATION

MBB'S MEASURES TO MAKE PRODUCTION MORE EFFICIENT DESCRIBED

Bonn DIE WELT in German 17 Nov 84 p 3

[Article by D. F. Hertel: "The Modern Airbus Bears the Stamp 'Made in Stade'"]

[Text] Five years of reorganization and rationalization have created secure jobs in the North German aircraft industry. Subassemblies for 40 Airbuses are produced and installed annually and capacity is by no means exhausted.

The inhabitants of the lower Weser must bid farewell these days to a maritime curiosity. The "Weserflug 1," the only German aircraft carrier is being removed from service. Its previous assignment, the transportation of aircraft sections between Nordenham-Einswarden and Lemwerder near Bremen, is no longer required.

This is a consequence of comprehensive reorganization in the Aerospace company Messerschmitt, Boelkow, Blohm GmbH (MBB). It became a necessity after MBB fused with the other large German aircraft manufacturer VFW (Vereiningte Flugtechnische Werke) five years ago. The fusion resulted in a situation which was untenable from the standpoint of manufacturing economics. Subassemblies for the German portion of the European Airbus wide body aircraft were being manufactured not only at five different locations but also with the same fabrication methods at two to three locations. That led to increased costs and to superfluous overtime work.

The available rationalization potential has been fully exploited in the past five years. The five factories were united as an operating unit. One primary manufacturing method was concentrated in each of the factories; and as this happened, the other factories had to give up traditional manufacturing activities.

Translated into technical reality that means: All milled parts are produced in the Varel factory on the Jade where the machining center was established. Small sheet metal parts are made at the Bremen factory. The Einswarden factory makes the fuselage plates which are then assembled into finished fuselage sections in the Hamburg factory. Finally, graphite fiber reinforced plastic aircraft parts are concentrated in the Stade factory.

MBB's new organizational concept necessitated investments in the amount of about DM 750 million. A part of this sum was required for the construction of new factory space, another part for spares provisioning which was needed in any case. However, even a larger part of the money, almost DM 0.5 billion was used for

highly modern and likewise highly automated machines. In the process, of course, about a thousand jobs were lost at the five locations. Hans Guenter Eidtner, factory council chairman at the Hamburg factory: "We assented since we hope that we have now created modern fabrication methods which can thus assure the remaining jobs."

Company spokesmen place an annual value of DM 50 million on the rationalization advantage resulting from the force reduction. And this advantage is needed because, explained Hartmut Mehdorn, chief of Airbus manufacturing at MBB: "We have got to become cheaper, otherwise we will get no orders. We are still about 20 percent higher per manufacturing hour than our American competition. The gap cannot be closed by simply working faster; it can only be closed by greater rationalization."

All Airbus production in the five factories is computer controlled. In this process the computer not only monitors production; it sees to it that that every part is manufactured exactly when it is needed. The raw, semifinished and finished inventories are monitored and controlled in the same way as the automated milling machines.

Previously, at least in theory, each of the five factories could have built a complete airplane. Today that is no longer possible. Thus, thanks to the "differentiated, computer-based total concept of prefabrication, manufacturing and quality control," work can be accomplished not only cheaper but also more accurately with lower parts tolerances.

A consequence of the realignment is that transports are continuously shuttling between the five factories. They bring sheetmetal parts in large containers from Bremen to Einswarden and Hamburg, machined parts from Vrael to Hamburg and Einswarden, fuselage skins fron Einswarden to Hamburg and vertical stabilizers from Stade to Hamburg. Then in Hamburg fuselage and tail sections are joined. Final assembly of all Airbuses is accomplished in Toulouse.

Three times a week the "flying whale," the gigantic four-engined turboprop transport aircraft Super Guppy lands on the MBB factory airstrip in Hamburg-Finkenwerder to load large subassemblies. Twice a week the Super Guppy lands in Bremen bringing semifinished wings from England and loading finished wings for Toulouse. And when sales improve, the Super Guppy will come even more often to Bremen and Hamburg. Presently, about 40 A-300 and A-310 Airbuses are being built each year; half again as many could be built by utilizing full capacity.

The smallest of the five North German MBB Airbus factories, the Stade factory, was threatened with closing for a long time after the fusion. Now it is among the most panic-proof factories because the secure production of fiber reinforced composites (CFK) [graphite fiber reinforced plastics] is concentrated here.

Today, all Airbuses are equipped with a CFK rudder. The future little brother of the present Airbuses, the A 320, however will have a complete vertical stabilizer of CFK. The greatest advantage of this material is that it is about 20 percent lighter than aluminum. The lighter the aircraft, the less fuel it requires (or the farther it can fly with a greater number of passengers). So the day may not be far off when yet considerably more aircraft parts will be made of composite materials: "made in Stade."

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COMPUTERS

DATAFLOW MACHINE RESEARCH PRESENTED AT FRENCH CONFERENCE

Paris MINIS ET MICROS in French 22 Oct 84 p 25

[Article: "Data Processing Convention: Layouts of the Future and Dialogue Between Man and Machine"]

[Excerpt] The Data Processing Convention which, like every year, precedes the SICOB [Exposition of Office and Business Supply Industries and Office Organization] covered many points for reflection in all areas of the profession. As we could not "cover" the exposition fully, we have been interested more particularly in new layouts and in the man-machine dialogue.

Dataflow Machines in the 1990's

Mrs Francoise Andre described the research carried out on systolic machines at the IRISA [Institute for Research in Data Processing and Random Systems] in Rennes [Brittany]. A systolic machine is composed of a network of data processors communicating with each other and in which the data is expanded and modified. A processor receives a data entry, processes it, and distributes to its neighboring processors the results which will serve as a basis for new calculations.

Each of these processors has a simple structure. A systolic machine is therefore an assemblage of many simple processors, whereas a Von Neuman machine consists of a single, complex processor. The propagation of data in the processors takes place under the influence of a synchronous cadence. This makes one think of the circulation of blood: hence the name, a systolic machine.

Thanks to a tool developed at the IRISA, the Diastol (Interactive Sketch of Systolic Layout), many simulations have been tested to determine the area for the use of such machines. This area of use is more extensive than may appear to be the case, when you tackle these investigations manually: image processing, calculation of graphs, signal processing (hence the transformed Fourier curve and the products of convolution).

The object of using a Diastol is to define a systolic layout automatically, on the basis of processing equations. It should first be reformulated, under a recurrent, uniform presentation (that is, bringing in the calculations made by other processors). The Diastol determines the number, the nature, and the cadence of the processors. It also shows the difficulty of starting up the processors before this machine is fully in operation.

A word searching circuit has been developed with a systolic machine.

However, it appeared that the synchronous control of many processors could pose a problem because of the propagation of time signals. Abandoning this simple but rigid sequencing is a possibility. Instead consideration should be given to introducing a little communications procedure between the processors.

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COMPUTERS

FRENCH WORK TOWARD 'FLEXIBLE SOFTWARE WORKSHOPS'

Paris LE NOUVEL AUTOMATISME in French Oct 84 pp 22-25

> [Text] The software workshop of the future, composed of specialized machine tools--data base machines, language machines, object machines--and capable of generating software which can be used on a given target machine are coming up on the horizon. Already some people are even dreaming of a flexible software workshop. This flexibility will be necessary to adapt such a software workshop to the great diversity of situations and of production in the field of program development. The Concerto projects, directed by the CNET [National Center for Technological Studies], and the Emeraude [Emerald] national project directed by Bull, SYSECA, and EUROSOFT, provide an early indication of what these flexible workshops will be like.

The flexible software workshops naturally involve automatic data processing specialists and product specialists who, for their part, develop such systems as the LMAC, which is capable of generating real time systems for data production purposes, or the PTA project (data processing specialist post)--drawn up by PSA, the RNVR, and ADEPA.

The fact is that old-fashioned programing, with a pencil and a piece of paper, is now old hat. As in the case of mechanics, when a CAO is applied to programing, it will make it possible to work more efficiently and to turn out products of consistent quality. It was at the Second Congress of Software Engineering, organized by AFCET and which had a display of software prepared by the ADI and the ANL (National Software Association), that an overall view and a display of the state of the art were shown, concerning methods and automated tools used in the programing process.

However, in reality software engineering activity begins with defining the problem.

Specifications

This involves carefully defining the problem raised by the customer. It should be admitted that many difficulties encountered in subsequent stages (development and maintenance of the software) could have been avoided if the problem had previously

been defined more precisely. This is what has led to the development of many languages for developing the specifications of a problem.

Good specifications are the basis of all development. To be good, specifications must be clear, unambiguous, complete, readable, and open to change.

To achieve these characteristics, one should use an automatic software specification tool, based on a recognized specification method. Among the specification methods most commonly used throughout the world we might mention the SADT system (Structured Analysis and Design Technics) produced by the American company Softech and by the Institute of Software Engineering (IGL) in Paris, as well as IDEFO. The IGL has developed "Specif," an automatic system for assisting the specification process, which supports the SADT and IDEFO methods.

Conceiving a Solution

The crucial point in program development is the passage (or transition) from the phase of analyzing a problem (specification) to the phase of conceiving a solution. The traditional method only makes use of the experience of those conceiving the solution and assumes that we start from zero with each new study.

The method that will be used in the future, and which is entirely automatic, will make it possible to move from the analysis of a problem to conceiving a solution. That will only be possible when we will have "expert" systems of conception which are sufficiently powerful to encompass the intelligence and the experience of software developers. At present we have not reached that stage. However, we might halt for the time being at a point midway between these two extremes. For example, we might use the methods of analysis and conception described by Michel Lissandre, director of methods and training at the Institute of Software Engineering (IGL). These methods use SADT and MACH (Method of Analysis and Hierarchical Conception) software.

A similar solution has been described by F. Schlienger and J. Corbin. It makes it possible to develop a program whose structure corresponds automatically to the specification structure. For this purpose it simultaneously manages the specification and editing of the program in a closely overlapping way. That process does not require a tedious period of apprenticeship. Further, errors of syntax are automatically set aside, both in the specifications as well as in the program. Oversights and input typing errors are closely checked.

Michel Beaudouin-Lafon and Christian Gresse, of LRI in Paris XI [Eleventh District] at Orsay, have developed the idea of presenting the data and the programs on a monitoring screen, which increases the simplicity and the speed of the process of construction. This is still only experimental and has the sole purpose of proving the feasibility of this idea, which will considerably improve the industrial production of software. This method is called "Assisted Construction on the Basis of Types" (CATY).

Measurement of Program Quality

This is a very broad question, since the elements involved in it are innumerable. In English this is called "Software Metrics." In French this is given several

names: "controle de qualite" [quality control], "metrologie" [meterology], or "logimetrie" [logimetrics], the latter of which seems the best to us. There is an evident need for this, which justified the fact that the last 2 days of the Congress of Software Engineering were devoted to this aspect. The fairly clear title given to this phase was "Quantitative Approaches in Software Engineering." The objective of this seminar was to bring us up to date on the measurable elements of software and to evaluate the effectiveness of the procedures for conception and development, as well as the human and material resources necessary for such development, and finally to follow the progress made in software projects.

The measurement of program quality made it possible to choose, for example, among several software programs now on the market, which resolve the same problem.

Serge Bouchy (from SOPRA) told us: "You have to go into the field of the practices which you should evaluate, check, and qualify in order to know whether this kind of service is really worth providing and whether its cost is appropriate."

On the other hand Pierre Morliere remarked to us that: "In all the sciences and technical fields measurement is the heart of the matter. It makes it possible to verify assumptions. We reach the point of considering software as an object with properties which we can measure and no longer as an abstract or mathematical thing, an algorithm, an idea which we used to think could not be measured. We distribute certain kinds of software in millions of copies (video games; Visicalc --450,000 copies). The cost of measurement is therefore negligible."

Measurement of Complexity

Narayan C. Debnath, of the Department of Computer Science, Iowa State University, began his presentation as follows: "The measurement of software complexity plays an important role in forecasting the development cost of projects. This kind of measurement can be very valuable when it makes it possible to estimate the time required to develop software." If several forms of softwre resolve a given problem, it is interesting to know which will be the quickest to solve it.

On the other hand the number of errors in a program increases with its complexity. Otherwise stated, the reliability and the complexity of a program vary inversely. As a general principle you can thus predict which are the subordinate elements of a program with high risks of errors. (Contribution of R. Ferreol of CIMSA.)

Pierre Morliere presented us with another point of view: "At present we have many ways of making microprocessors go well beyond what they are currently doing. The limiting factor is not the cost, since this will be reduced by broad commercial distribution of the microprocessors. Rather, the limiting factor is our capacity of knowing how to construct very complex software in a very rational way and which works. Well adapted software tools must be developed.

"We should distinguish between intrinsic complexity (concerning the problem to be resolved) and the complexity of the product which satisfies this problem. Here are a few examples of complex problems: vocal analysis, automatic reading of hand writing, automatic translation of computer languages of excellent quality, and robots. The tests become very complicated when they involve complex programs."

Regarding the translation of computer languages, we might note the presentation by INRIA (Domaine de Voluceau-Rocquencourt-Le Chesnay): "The application of high level tools for the development of an automatic translater of PASCAL into ADA." Thanks to these software tools, it only took five man-months to conceive and develop it.

Tests and Validation

The development of batteries of tests can also be helped by the use of appropriate software. In this connection Bernard Houssais (of IRISA at the University of Rennes) brought together about 100 errors found in the compilers of "Algol 68" and deduced a method for the systematic production of tests for compilers. This method can be generally used, either concerning the production of tests or for the analysis of errors. Its objective is limited to the simplest and most ordinary errors. The very systematic structure of these tests lends itself well to automation.

Test generators have been created to develop a trial system aimed at testing a certain type of software in all of its possibilities. This is a kind of automatic "made to measure" program, like the production of clothing to individual measurements on an industrial scale [mesure industrielle]. However, there is an inevitable rate of breakdowns.

Most of the software testers agree on the many advantages provided by the execution of all instructions and all possible variations (or "routes") of a program. M. R. Woodward, of the Department of Computer Science of the University of Liverpool in Great Britain, has developed an algorithm making it possible to calculate the minimum number of "routes" which cover all of the instructions and variations, either all the "LCSAJ" or all pairs of "LCSAJ." "LCSAJ" means the notion of "Linear Code-Sequence-and Jump." This is an element of a variation based on a text and which corresponds to a straight line sequence of text, through the command for starting operations, which can be seqnential and can end with a jump in the program.

Reliability

The concluding day, 5 June, was devoted to the measurement of the reliability of software in all of its aspects.

Industrial software, which is generally of the "real time" type, requires high levels of quality in use and in maintenance. The INSA and APSIS are collaborating in the development of aids for the production of industrial software in real time. They are aiming at achieving reliability from the phase of conception of the software, using an aid provided for the development of the test plan, and a followup aid for tests.

The ratio between the number of errors found and the number of errors existing in a program is called the rate of coverage. The actual number of errors is evidently unknown. It is certain that the probability of finding a new error tends to move asymptotically toward zero when the number of errors already found and the number of tests performed increase. (Contribution of G. Morganti of Bell Systems.)

Two broad categories of approach in terms of the extent of coverage can be distinguished: "structural" tests and "functional" tests. An approach to the measurement of test coverage has been developed by the Electronique Serge Dassault Company, using the "IDAS" system.

An improvement in the measurement of test coverage has also been proposed by the Center for Studies and Research of IBM-France at La Gaude, near Nice. It uses new, dynamic indicators in place of the indicators of the quality used until now, which were static in character.

Richard N. Taylor, from the Department of Information and Computer Science of the University of California at Irvine, described techniques for the location of errors in applied software in real time. This software was often developed by a host machine and then recompiled for use by a production machine less powerful than the original host machine. Often the production machine had no software of its own and even no exploitation system. Under these conditions it is difficult to check the quality of the software in the production machine. The author proposed a partial solution to this problem.

Project Management

Forecasting models are presently being used by economic officials of companies and government services to prepare budgets, work out development strategies, and predict how long a project will last and the number of people required for it at varioua stages. The Oresys Company has developed forecasting models which have been tested on developments of French software.

CIMSA is using the "COCOMO" model (Cost Constructive Model) proposed by E. W. Boehm in the United States for the TRW Company. It is necessary to use corrective factors to take into account the differences between CIMSA and TRW.

P. Marlard of the Center for Studies and Research of IBM-France in La Gaude, near Nice, has shown that the cost of work carried out on a computer with a response time of less than a second declines considerably if this work is done using interactive equipment. That is due to the fact that the time of the users is much more expensive than the time of the computer they are using.

Serge Bouchy of SOPRA told us: "All of that shows that we realize that data processing is not going to develop without consideration of the cost, because we are going through a period of economic change. We have to "tighten our belts" to produce better, more, and cheaper. That will only be possible if we make progress in software engineering. That will probably reduce the present infatuation for the profession of a data processer. This profession will become even more demanding. It will certainly not be an easy job, and it will not necessarily command fantastic prices."

The Concerto Project

Directed by the CNET [National Center for Technological Studies], Concerto is a proposed, flexible, advanced type of workshop. The equipment of the workshop is based on an SM90 computer and a UNIX operating system. The core of the system used in the workshop is on the basis of ULYSSES (a computer language in

conversational style based on LELISP and which offers users a structure and form of synchronization between coders in separate places.). The overall structure is made up of an operating system which prepares and processes software material; a directional system which can observe and act on the operating system, giving it commands; and an information system making it possible for the two preceding elements to interact with the workshop on a permanent basis. The workshop as a whole is built on a data base defined by an F1 unit (an entity relation model with rational calculation) which determines the rules appropriate to the operating organizations. The objective as of the end of 1984 is to have a system capable of running programs in PASCAL with an interpreter which is both a developer and generator of multi-target codes corresponding to 68000, LSI-II. Subsequently, it is planned to develop an environment to specification.

Exhibitions at Software Exposition

Automatic Translater - PASCAL ADA-INRIA (Voluceau)

Portable Equipment for the Management of Cathode Ray Tubes - EDF (Clamart)

System to Assist in Cathode Ray Tube Management (Reve 22) - Crin (Vandoeuvre)

Integrated Software Workshop - IPI (Paris)

Prototype SSP Software Engineering Workshop; Specification: Automatic Equipment to Assist in Specification; Qualimeter-C; Program Quality Analyzer - IGL (Paris)

SPRAC-LF: Expression and Management of Algorithms and Representation - ONERA, Cert. Deri (Toulouse)

Experiments with Generic Programing in LPG - IFIA/IMAG (38402) [Postal Address]

SOPIADOC - LISH/CNRS Document Management Interface (Marseille)

Pallas-Steria Software Engineering Workshop (Velizy).

Software Life Cycle Model SLIM-P. A. Computers and Telecom (London)

ADELE Program Base - IMAG (Grenoble)

Software Reliability Evaluation Workshop: Complexity Analysis Equipment - OGL (Toulouse)

LMAC Software Development System for Production - Information Laboratory, University of Nice and Besancon μS robotics

Concerto Information System - CNET/CERT/CETE (Lannion)

Model of Management System for Versions Using Logical Programing (Foll. Prolog) - CRISS (Grenoble)

Caty-Asspegique-Petripote-Spada - University of Paris - South (Orsay)

Microcomputer Books and Software - Addison-Wesley (Amsterdam)

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FACTORY AUTOMATION

FRENCH FACTORY HAS 'WORLD FIRST' IN FMS FOR STEEL SHEET

Paris INDUSTRIES & TECHNIQUES in French 1 Oct 84 pp 39-41

[Article by Pierre Iticsohn]

[Text] No sooner ordered than executed. Aldes switches without delay from one family of parts to another. Its FMS [Flexible Manufacturing System] involves world-class innovations (laser, local network, etc...).

Equipped with a 1,000-watt cutting-laser and entirely computer-controlled via a local network, the manufacturing system installed at Aldes is a world first from the standpoint of flexibility in the sheet-steelworking domain. To manufacture the 3,000-or-so parts in varying types and quantities for the 2,500 items in its finished-products catalog will now require between 24 and 48 hours, as compared with 1 week heretofore. The president of the firm, Bruno Lacroix, appears to awaken from a dream. "Three years ago," he explains, "we were but talking of cutting-lasers, and we were imagining manufacturing processes that would abolish adjustment corrections and intermediate stocks. Today, we no longer fantasize! The dream has become a reality."

The "ventilation" department of the Aldes firm manufactures, since 1969, complete mechanical ventilation systems for the building trade. These systems include vents, fans, ducting networks and accessories. Of the 2,500 catalog items, 1,500 concern only the accessories. Most of these items are manufactured on a small- to medium-scale production basis, involving from a few units to a few thousand units per month. For the accessories pertaining to any one catalog item, the quantities are rather of the order of a few units to a few hundred units per month. This atomizing of production becomes even more diffuse when one considers that these manufactures are spread over more than 2,000 orders per month.

Required delivery times--1 to 2 weeks maximum from issue of the order to receipt of the equipment on the job site--and the wide variety of catalogued products, impose a rapid processing of information and, normally, a stockpiling of products. But stockpiling is possible only for items consumed at a monthly rate exceeding a certain threshold level. Heretofore, accessories fabricated upon receipt of order were routed to a sheet-metal shop where, for each item ordered, a handmade tracing was made from a template, then a cutout was made using chisel and nibbler, and finally, depending on the accessory,

it was put through one or more of the following operations: Rolling, welding, molding, and deburring. The average time involved was 1 week.

The shop was hard-put to adapt to the variations in demand, which could double from one week to the next. Most of the ducting accessories are built around a cylindrical body and chippings that are also cylindrical (many of the other items fabricated also involve cylinders: sleeves, fire-stop dampers...). Bruno Lacroix made it his first objective to automate the fabrication of these cylinders. "In addition to the ducting accessories," he points out, "we found that many families of items produced on a medium-scale could very advantageously be fabricated using a cutting-laser. The technique has the advantage of reducing production-line quantities and stocks of spare parts; it also does away with the need to design and build cutting-press tooling." The constraint sine qua non on the automation project: All equipment must be French! This made it necessary to answer the basic question: Who would be given the prime contractorship? "The fact is," explains Bruno Lacroix, "that no one wanted it. We therefore decided to take it on jointly with CN Industrie, the designer of the system's data processing component, the very foundation of the edifice."

With five modules (unrolling, cutting-laser and table, rolling, marking, welding), the installed FMS marks a world first in the domain of sheet-steel-working. Equipped with two inputs geared to accept steel sheet in rolls as well as in sheets, it embodies a panoply of technological innovations. "It was necessary to modify standard hardware and more often than not to create new machines," says Michel Marillach, Aldes's technical manager. "Three years ago, we still had very little experience in CNC [computerized numerical control] techniques. The NUM 560 numerical control system, developed by CN Industrie, is a first in this domain. Similarly, there was no such thing as a rolling machine or a cutting-laser capable of working directly on steel sheet in rolls." Paul May, president of CN Industrie, states: "The only unresolved obstacle lies in the remote loading of the NUM 560 in idle time, an absolutely impossible operation."

The core of the system is, indisputably, the cutting-laser by CILAS (a subsidiary of CGE [General Electric Company]), the first laser capable of cutting steel sheet in rolls or in sheets, in thicknesses of up to 6 mm. Its power is 1,000 watts. It is controlled in the X and Y axes by an NUM 560 numerical control system and slaved in the Z axis to follow any possible deformations in the steel sheet.

Associated with a cutting-table by Limoges Precision, the laser works irrespectively of whether the material is in individual-sheet or roll form. The loading and unloading operations, still manual, are in the process of being automated. It is planned to install a manipulator, around the beginning of 1985, to transfer pieces between the rolling and welding machines.

Order by Order

This is a particularly delicate operation in that the manipulator must handle rolled--hence not rigid--cylinders with diameters varying between 100 and

500 mm and widths between 80 and 650 mm. Two computers contribute to the flexibility of the system: An HP 9836 which manages the different files, and an A 600 (by the same manufacturer) which handles the NC's and the programmable on-line automatons via a Compex 50-kbaud "LAC" local network.

The routing of an order is easy to follow. Received by one of Aldes's nine commercial offices, the order is immediately transmitted via a terminal in that office to the NCR management computer installed at the company's head office. Depending on the required delivery date of the order, the Shipping Office selects on a terminal all the orders to be shipped on day D.

On day D-2, the Shipping Office provides a displayed listing of these orders. The management computer selects all the items to be fabricated and transmits to the A 600 production computer the list, the quantities and the order number concerned. The A 600 consults the HP 9836's files and makes a "shooting-script," that is, a juxtaposition of the items to be produced, one after the other, for each roll of steel sheet. The production of the items, order by order, translates the flexible character of the production line.

Based on the "shooting-script" (in which additions or cancellations can be made at any time), the computer searches out all the information, such as NC programs, needed to control the machines. It provides for their coordination and the linking together of the components and subsystems involved. As each order is completed, the computer launches the fabrication of additional small parts to ensure using up the entire width of the roll of steel sheet, including scrap.

To optimize use of the laser, should it be momentarily in waiting while working on a roll of sheet metal on one table, an idle-time indicator enables the laser to move over and cut a sheet in waiting on another table. As they come off the production line, the pieces are grouped by order and automatically marked by an ink-jet machine.

Though it is still too early to draw up an intial economic balance sheet, it is already certain that the full amortization of the investment--a total of 6 million francs, including an interest-free loan of 450,000 francs from the ADI (Data Processing Agency) and a subsidy of 750,000 francs under the MECA [Advanced Design Machines and Equipment] procedure--will take between 3 and 4 years. Having now resolved the production-line phenomena and stockpiling problems involved, having shortened its manufacturing times to a maximum of 48 hours, and having considerably reduced its scrap-material wastage, Aldes is in a fair way to scoring a first... "le Kanban a la lyonnaise!"

[Boxed insert p. 40]:

Aldes

Formed at Lyons in 1925, the Aldes firm specialized initially in metal-cutting and press work on subcontract. In 1969, it reorganized into two departments: The "metal-cutting and press work" department and the "ventilation" department. As of 31 December 1983, it had 325 fulltime employees and

an annual revenue of 134 million francs exclusive of tax. Its cutting and presswork activities, which are concentrated at its Venissieux plant, occupy 70 persons and account for 16 percent of its total revenue. Its "ventilation" activity accounts for the rest. As of 1984, Aldes has half the collective-buildings market and one-third the individual-homes market. It is also a leader in the field of fire-stop dampers and of fumes-exhaust systems, owing to the majority capital shareholdership it has acquired in SGEI [expansion unknown].

[Caption under photo at top of p 39]: First 1,000-watt laser. It cuts steel sheet up to 6 mm thick.

[Caption to photo at bottom of p 39]: The rolling machine, 650 mm wide, is equipped with 2 step-by-step motors. Their control and positioning can be different to accommodate an expanded cutting shape.

[Caption to photo pp 40-41]: Cutting table associated with laser. Controlled by an NC, it accommodates the cutting of steel sheet in rolls or in sheets.

[Caption to photo at lower right p 41]: Assembly of the fabricated parts is fully data-processed. Scrap is reduced to a minimum.

9399
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FACTORY AUTOMATION

HAMAI OF JAPAN SIGNS MACHINE TOOL CONTRACT WITH FRENCH FIRM

Paris L'USINE NOUVELLE in French 11 Oct 84 pp 52-53

[Article by Patrick Piernaz]

[Text] Intelautomatisme has just signed a far-reaching agreement with the Japanese firm Hamai, which specializes in the building of vertical machining centers, milling machines and gear-grinding machines.

The two firms have agreed to enter into a technological and industrial joint venture involving cessions of licenses, exchanges of know-how, and a concerted approach to the North American market. Specifically: Intelautomatisme will produce under license, beginning in 1985, Hamai's vertical machining centers, in its Graffenstaden plant, near Strasbourg. This equipment will be fitted to European standards insofar as concerns broaches, toolings, electrical equipment and safety devices. The French firm, which already has a sizable product line (millers and horizontal machining centers), will also be rapidly supplementing its line of vertical centers in a domain in which it has had only one model, its Hure CX center. As a matter of reciprocity, Hamai will distribute the world-famous Hure millers and will be entitled to build them under license, for the entire Southeast Asian market.

To be sure, this agreement is in perfect alignment with Intelautomatisme's strategy, which is based on forming alliances that meet three criteria: Supplementing of its product line, enlargement of its distribution network, and acquisition of expertise in systems. "The agreement with Hamai meets these three conditions," says James Deas, manager of marketing and development.

But for all that: Is signing with a Japanese firm not an admission of impotence? The Intelautomatisme holding company, which controls Hure and Graffenstaden, is one of the principal mainstays of the French machine-tool plan aimed at revitalizing the French industry, which has been badly mauled by the Nippon invasion. Furthermore, was it really necessary to create in France a second center for the production of Japanese machine tools (the first being that of Hes-Toyoda), after having reproached the British with having welcomed the Japanese No. 1--Yamazaki--with open arms? One is forced to accept the fact that, month after month, the Japanese are enlarging their presence on European soil in the face of builders who are unable to reach agreement among themselves to make common cause.

And yet, should reproaches be heaped on Intelautomatisme? The French firm has held talks over the past several months with all the European builders, and if it has signed with a Japanese firm, it is clearly more out of pragmatism than a lack of community-mindedness. It is also true that the nature of the Franco-Japanese agreement is in no way that of a renouncement. And the comparable size of the firms (they both have annual revenues of around 400 million francs) facilitated their rapprochement. However, by consulting Hamai's employee rolls, the French management has gained an exact measurement of the road distance it must still travel. For equal annual revenues, the Japanese firm employs 350 persons versus Intelautomatisme's 1,100 employees. Another reason for Etienne Roussel, the latter's CEO [chief executive officer] to pursue his industrial plan, which will cut staffing back to 550 persons and concentrate all production at Graffenstaden. And he will have to act fast if he wants to attain the goal he has set for himself, which is, to be in the forefront among the European builders by 1988 with 10 percent of the market. The French firm, which is controlled by Indosuez, has the means to achieve this goal, even though CIT-Alcatel's withdrawal of capital (it has just reduced its share from 49 to 19 percent, to the benefit of SIPARI [expansion unknown]) might lead one to conclude that at CGE [General Electric Company] there is some doubt as to the future profitability of the French No. 1 in catalog machine tools.

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FACTORY AUTOMATION

'NOVEL CONCEPT' IN DESIGN OF ASEA'S NEW ASSEMBLY ROBOT

Paris L'USINE NOUVELLE in French 11 Oct 84 p 54

[Article by Michel Defaux]

[Text] The disclosure caused excitement in the aisles of Exposition Robot 84 at Goteborg (Sweden): The Swedish giant, which over the past several years has accustomed us to a rate of one new product per year, has made an entry into the robotics of assembly. Knowing its prudence (it is one of the last of the giants to attack this domain), but also the sureness of its marketing approach, one is inclined to think that the explosion of the assembly robotics market, which the specialists have been promising us on a recurring basis for the past 5 years, is now in view. "This is still not yet the real lift-off," says Bjorn Weichbrodt, general manager of ASEA Robotics, "but already in 1983 there was a doubling of applications of assembly robotics. And, according to the latest figures provided by the Japanese builders, 45 percent of the robots sold this year will be for assembly applications."

To carve out a place in this hotly contested market, ASEA has not shrunk from incurring expense. Its assembly robot, design studies of which began in 1981, has required the equivalent of 30 men a year for 3 years.

An Innovative Solution: A Suspended Arm

The result: A product based on an entirely new concept that has emerged from the Vasteras design offices. "To achieve this," explains Trygge Sthen, head of the Assembly Systems Department, "we have taken advantage of the experience we had already gained in this domain with conventional robots. We have installations that have been in operation since 1977 at Saab-Scania, for example. We have taken into consideration the requirements of users who want faster speed in the performance of operations."

After a study of the constraints inherent in the three configurations currently available on the market (rectangular coordinates, Scara type, and poly-articulated structure), the group's engineers developed an entirely new concept: The pendular robot. "We have tried to combine the advantages of the existing models for the assembly of small components on a medium-scale production basis," we are told by Ulf Holmquist, the Assembly Department's

marketing manager. "We have arrived at an original solution: A suspended arm with three degrees of freedom and a vertical travel, with two degrees of freedom at wrist level. This arm swings in two directions; hence the term "pendular." The advantage of such a configuration, besides the volume of work performed, lies essentially in the fast acceleration (+50 percent over conventional models) and the speed of displacement of the arm, an important characteristic in assembly work, which involves going in search of components to the right or to the left.

In keeping with its turnkey policy, ASEA has also developed an entire environment (an 8-gripper wrist, a highly self-regulated parts supply system, clear field of view, etc...) and states today that such a robotized assembly position permits a gain of 40 percent in assembly cycle time over previous assembly positions. Already, a robot designated the IRB 1000, with a capacity of 3 kg, is operating at Electrolux and assembles windshield-wiper motors for Volvo. Of course, ASEA is aiming at the automotive market, but also at the entire electrical industry. "This year, we have sold a total of 1,400 robots throughout the world," says Bjorn Weichbrodt, and concludes: "Insofar as concerns our assembly robot, we plan to build 200 units beginning next year in our Vasteras plant, before undertaking production in our plants worldwide."

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METALLURGICAL INDUSTRIES

FRENCH FIRM HAS 'MOST ADVANCED' CONTINUOUS-CASTING MACHINE

Paris L'USINE NOUVELLE in French Supp to 18 Oct 84 pp 16-17

[Article by Jean Roume: "Continuous Casting"]

> [Text] With Amaryllis 2, Solmer is achieving maximum productivity, security and operating comfort at minimum cost.

Like ships, it has a name. Amaryllis 2 produced its first slabs on 19 September at Solmer's Fos plant. It is the most advanced continuous-casting machine in the world, a machine that even the Japanese envy us. For the plant workers, it is also a major piece of the "new iron and steel industry" that they have undertaken to build. It would be nonsense to overlook this "human" dimension of Amaryllis 2.

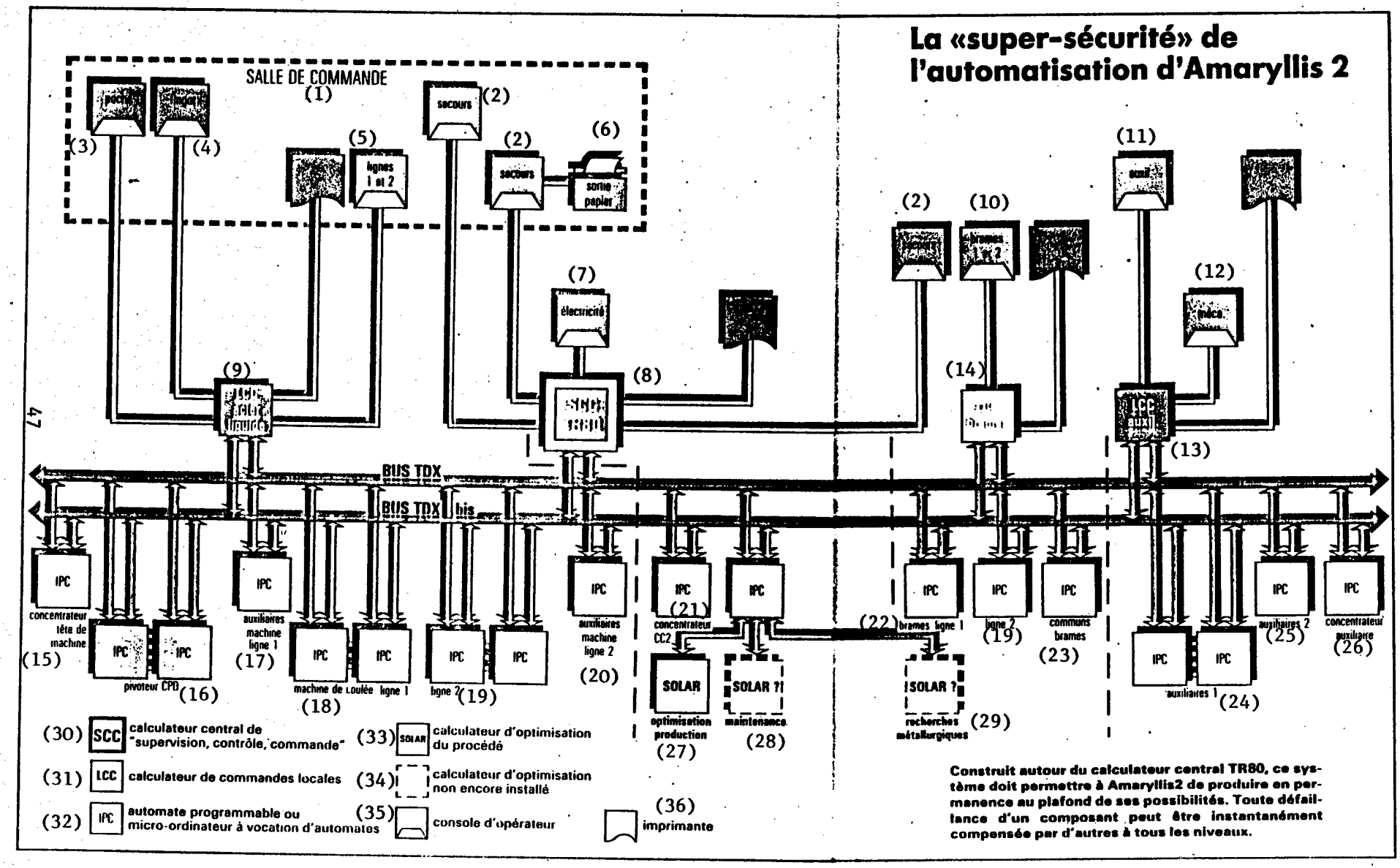
Subcontractors and the main supplier agree. "All the features of this machine and all the work stations have been discussed until the solutions we presented were accepted by our principals as well as by the operating personnel at all levels," we were told by Bernard Lacoste and Joseph Pietryka, heads of the Continuous Casting department of Fives-Cail-Babcock and in charge of the electromechanical setup.

Amaryllis 2 is a two-line machine with a curved ingot mold and an annual capacity of 2 million tons. It produces slabs with a thickness of 220 mm and a width ranging from 1,050 to 2,200 mm. With its auxiliary equipment, it represents an investment by Solmer of the order of FF 700 million.

Going down the line, the first spectacular innovation is the fact that no one is working on the casting floor any more--a difficult and dangerous job. Thanks not only to the full automation of casting operations, but also to the use of a remote-controlled robot specially built by the Ivry plant of FCB [expansion unknown]. It places the refractory tube under the liquid-steel ladle, starts preheating another one and cleans the one that was just used before reusing it.

The automation and control of liquid-metal casting were optimized through an original Solmer-IRSID [Iron and Steel Research Institute] method designed to reduce, or even eliminate, surface defects in slabs (hot tears and perfora-

La «super-sécurité» de l'automatisation d'Amaryllis 2



Construit autour du calculateur central TR80, ce système doit permettre à Amaryllis2 de produire en permanence au plafond de ses possibilités. Toute défaillance d'un composant peut être instantanément compensée par d'autres à tous les niveaux.

The "Super-Safety" of Amaryllis-2 Automation

The system is built around a central TR80 computer and should enable Amaryllis-2 to operate continuously at maximum production capacity. If any component fails, other components at all levels immediately take over.

Key:

1. Control room
2. Backup
3. Ladle
4. Ingot
5. Lines 1 and 2
6. Paper output
7. Electric power
8. TR80 central supervision, control and command computer
9. Liquid steel local-command computer
10. Slabs 1 and 2
11. Auxiliary
12. Mechanics
13. Auxiliary local-command computer
14. Slab local-command computer
15. Machine-head concentrator
16. CPD [expansion unknown] swiveller
17. Line-1 machine auxiliaries
18. Line-1 casting machine
19. Line 2
20. Line-2 machine auxiliaries
21. CC2 [expansion unknown] concentrator
22. Line-1 slabs
23. Line 2
23. Slab buses
24. Auxiliaries 1
25. Auxiliaries 2
26. Auxiliary concentrator
27. Production optimization
28. Metallurgical research
30. SCC: Central "supervision, control and command" computer
31. LCC: Local command computer
32. IPC: Programmable controller or microcomputer used as programmable controllers
33. SOLAR: process-optimization computer
34. Optimization computer not yet installed
35. Operator console
36. Printer

tions). The complete modelling of a "zero-defect" casting process is made easier by the fact that the ingot mold can be made to oscillate up to 400 times per second (compared with 180 times on the Solmer No 1 continuous-casting line) and by the air-plus-water projection system developed by FCB, which provides for a more extensive modulation of cooling compared with traditional water processes.

Another innovation. The continuous optimization of width changes. The intermediate trapezoidal slabs present differences that are still small enough to allow for rolling, which saves them from being rejected. Among many other innovations, Amaryllis 2 is also the first machine with a four-roller magnetic agitation system in the midst of the secondary cooling (IRSID-CEM [Electromechanical Company] system), an important contribution to the internal quality of the metal. The roller geometry was redesigned and patented by FBC, and the rollers are very easily disassembled.

Another original feature: the automation system designed and produced by Clemessy in close collaboration with Solmer experts. "This is the first continuous-casting machine that is entirely controlled from a single control room through a centralized data-processing network," we were told by Michel Fietier, delegate and coordinator of the various Clemessy departments. The company transposed in Fos the Emir system it provided for the Kourou base, to supply fluids to the Ariane rocket. But the "very demanding clients" that were Solmer's principals forced Clemessy engineers to outdo themselves again as far as operational safety was concerned.

The process-control architecture is built around a central TR80 computer and includes in particular a redundant (duplicated) high-speed TDX [expansion unknown] bus. The three local command computers (machine head and robot, slabs, auxiliaries) can be instantaneously relayed by the central computer, should a failure occur. Similarly, the 23 microcomputers and programmable controllers responsible for the operation of the various mechanisms of the machine can help one another to a certain extent (direct links or backup controllers), or be replaced by one of the local command computers. "That means super-safety," according to Michel Fletier. Finally, a Solar computer dialogues with all control stations and continuously optimizes all manufacturing processes.

A second computer of the same type will be added; it will be in charge of machine maintenance. And a third one is considered for "metallurgical research," in other words to further improve steel quality.

It is therefore a wonderful tool and, together with the older Amaryllis 1, it enables Solmer to produce 100 percent in continuous casting. According to the operators, this will reduce by FF 60-160 per ton the cost of an intermediate product that is already competitive (around FF 1,300 during the first half of the year). But it is also a plant in which all difficult or dangerous jobs have been eliminated. And in which the new responsibilities--work on computers and screens--of 170 people (including 80 working in 5 shifts of 33 h 36 min each, for around-the-clock production) have all the characteristics of a promotion.

Managing Energy in Real Time

According to Rene Cornet, responsible for metallurgical quality and production planning at Solmer, it is also a stepping stone to achieve new and considerable productivity gains at the plant. Especially with the current launching of the NF 2 project (New Frontier No 2).

The details of this data-processing program are still confidential, but it will create an interface between the continuous-casting programs and those of the strip mill train. At the same time, it will take into account the variations of the backlog of orders and the cold-slab inventories. The goal is to further reduce the power consumption by raising from 30-40 percent to 50 percent the proportion of direct charging and rolling. The ultimate goal is to further improve metal and energy utilization to achieve the continuous real-time optimization of all strip mill train/continuous casting operations.

This is the road leading to the "new iron and steel industry."

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MICROELECTRONICS

SIEMENS, PHILIPS 'MEGAPROJECT' TO YIELD SUPERCHIP IN 5 YEARS

Philips To Invest 5 Billion Guilders

Rotterdam NRC HANDELSBLAD in Dutch 7 Nov 84 p 1

[Article: "Philips Puts 5 Billion in Megachips"]

[Text] Eindhoven, 7 November -- Over the next 5 years, Philips will sink a total of about 5 billion guilders into chip activities. That is a quarter of the total investment volume of the corporation.

Dr S. van Houten, member of the board of directors of Philips, stated this in an interview with NRC HANDELSBLAD.

According to Van Houten this financial effort indicates how much significance Philips attaches to integrated circuits. "As an electronics corporation we can continue to compete only if we are ahead in the area of chips."

This year Philips will sell about 3.5 billion guilders worth of chips on a world market valued at 65 billion guilders. According to Van Houten, the goal is to increase the turnover over a period of 5 years from 3.5 billion to about 8.5 billion guilders.

As a rule of thumb he suggested that for every guilder in extra turnover in the chip industry, 80 cents must be invested first.

With an intended growth in sales of 5 billion guilders, this means a financial injection of 4 billion guilders. "But we do not want only to follow the market growth," said Van Houten. "We also want to expand our market share. Therefore we are going to invest an extra 1 billion guilders."

Philips' net profits for the third quarter amounted to 241 million guilders, as against 103 million during the corresponding quarter last year. This was announced this morning by Philips. Over the first 9 months, net profits amounted to 785 million guilders, as against 362 million for January-September 1983. As percentage of the turnover and after deduction of taxes, net profits rose from 1.3 to 2.2 percent.

Strategic Importance of IC's to Philips

Rotterdam NRC HANDELSBLAD in Dutch Supplement 7 Nov 84 p 4

[Article by Dick Wittenberg: "Megaproject of Vital Importance to Strong Place in the Market -- Those Who Do Not Conduct Research Cannot Produce Either"]

> [Text] Megaproject is the impressive name given to the giant alliance of Philips and Siemens for the development of basic technology that will make possible the manufacturing of integrated circuits with an even smaller structure and an even greater memory capacity than before. One and a half billion guilders are being sunk in the project which will run for 5 years. Philips and Siemens will each pay 500 million guilders. The Dutch and German governments will pay the half billion guilder difference.
>
> How important is the Megaproject in reality and how "super" are those superchips going to be?

"An electronics corporation which is not in the lead in the area of chips will eventually have to drop out of the race." This is what Dr S. van Houten, member of the board of directors of Philips, said about the importance of chips to the corporation. "The 'integrated circuits,' chips, or simply IC's, have very high priority at Philips. They represent one of our most important key areas. The Megaproject is a vital part of that."

The chip market is experiencing a gigantic growth. The figures speak for themselves. In 1963, total sales of integrated circuits for the whole world amounted to $16 million. In 1980 the turnover already amounted to $10 billion. This year the world market is expected to go beyond $20 billion.

For the coming years a yearly growth of an average of 20 percent is also expected. Philips is of course doing its utmost to pick up as much of that as possible. And they seem to be succeeding nicely. Following a slow start, the Dutch corporation has developed itself over the last few years into one of the five largest IC manufacturers in the world.

As a result, the share of IC activities in the total turnover of Philips has increased at a frantic pace. Two years ago the sale of chips still represented only 3.5 percent of the turnover; this year that contribution will already be about 7 percent. This year the company will produce approximately 3.5 billion guilders worth of integrated circuits, of which only 15 percent for its own consumption.

Philips' ambitious plans foresee a 150 percent growth in the sale of chips over the next 5 years. Sales to third parties in particular are expected to go up. Consequently, by the end of the eighties the share of IC's in Philips' total shares will shoot past the 10 percent mark.

Tour de Force

This tour de force will require gigantic financial efforts. Because if there is one area where the saying "nothing ventured, nothing gained" applies, it is with chips. What prevails among American IC manufacturers is that they use an average of 30 percent of their turnover for research and development and for capital investments. In Japan that share lies around 40 percent.

According to engineer C. Krijgsman, director of the Elcoma production division for IC activities, Philips' efforts are closer to the Japanese than to the Americans. The Dutch multinational wants to add another scoop to that.

"We don't want only to keep up," said Van Houten, "we also want to gain ground." Therefore, over the next 5 years Philips will sink about 5 billion guilders into chip activities, about a quarter of its total investment volume. In addition, an important part of the 3.5 billion guilders, which Philips sets aside annually for research and development, will be spent on IC's.

This enormous appropriation of financial resources is not justified only by the attractive growth market. The importance of the chip goes much further for Philips. "The integrated circuit forms the heart of virtually all our products," explained Van Houten. "Whether we are talking about color television, videorecorders, compact discs, personal computers or medical electronics, for all those areas the IC is of strategic importance."

The advance of the chip can no longer be stopped. The IC still keeps getting smaller and more complex. And the price per function is still going down yearly by an average of 20 percent. This development opens the way for renewal of traditional products, but also for the development of completely new products and processes. The IC content of electronic equipment will continue to rise sharply. Van Houten's conclusion: "An enterprise which cannot keep up with this development doesn't have a chance."

Key Position

In the process of further reduction of the chip structure, the Megaproject holds a key position at Philips. It is no coincidence in this regard that in terms of the development of submicrotechnology Philips and Siemens are turning to C-MOS [Complementary Metal Oxyde Semiconductor] memories. There is first of all a technical reason for this. It is true that compared to bipolar circuits, C-MOS chips are slower but they have the advantage of a simpler construction, a smaller surface and a lower energy consumption. Hence, C-MOS lends itself most to superintegration.

Furthermore, in comparison with microprocessor chips for example, memory chips have the desirable characteristic of being terribly regular in structure. That simplifies design and testing.

Van Houten: "We are using the C-MOS memories as a vehicle to master the new technology. Later on we will also let the acquired knowledge loose on other IC's."

Philips also has another motive to throw itself suddenly and with so much enthusiasm into the C-MOS memories. It involves the market position and prospects for application. In the area of bipolar circuits it is more than clear that Philips sets the tone together with Texas Instruments. In terms of bipolar memories the Dutch corporation is supreme.

With MOS circuits, however, Philips has to be content with a remarkably more modest role. This is why a few years ago the enterprise launched a large scale catching up operation. And that is really necessary because the use of MOS chips increases far more rapidly than that of the bipolar circuits.

Memories

Hence, in the field of MOS memories Philips has not offered very much so far. "Not because of a lack of knowledge," emphasized engineer C. Krijgsman with great conviction. "It was a choice. That market segment was not that interesting to us in the past."

Meanwhile, changes have occurred in this. The C-MOS memories form the most rapidly growing sector of the markets. Krijgsman noted: "An ever increasing number of traditional Philips products has developed the need for some memory." In addition there is the fact that with IC's the gap between various techniques and types is becoming increasingly vague. In the future, it will be possible to bring together microprocessor and memory in a single circuit. Bipolar and C-MOS technology will be applied next to each other on a single chip. That means that not a single IC manufacturer can afford to remain aloof in any of the vital elements.

This also implies that only the very largest corporations are still able to operate at the front on a broad field of technology, stated board of directors member Van Houten. "They are the only ones still able to come up with the enormous amounts of money needed to keep pace with all vital developments. Because, according to engineer Krijgsman, the investments necessary to build and equip an IC plant increase by a factor of three, every 7 years.

It may seem strange that Philips is carrying out the Megaproject in Europe and then specifically with a European partner. And yet it is logical. As a matter of fact, Philips swears by a sound interaction between research and market. This means, for example, that Philips has completely concentrated the development of bipolar digital circuits, which are important primarily for industrial applications, in the United States. It so happens that that market is ahead in professional equipment.

For the same reason Philips has accomodated the C-MOS technology in Europe. C-MOS chips are used primarily in consumer electronics and that has traditionally been the area of Europe. Hence the Megaproject could not take place anywhere else either than the old continent. Because the project requires close and extremely intensive cooperation and the Atlantic Ocean is really too big a barrier, Philips also had to end up with a European partner.

Europe can benefit from it. "Because," said Philips leader Van Houten significantly, "the IC technology propels research. Without this stimulus Europe could not play an important role in the area of high technology."

Governments Set Conditions for Financing

Rotterdam NRC HANDELSBLAD in Dutch Supplement 7 Nov 84 p 4

[Article by Paul Friese: "Support Is Contingent Upon Stringent Conditions"]

[Text] The RSV [Rhine-Scheldt-Verolme] affair and the Nederbest debacle have demonstrated that the supervision of spending of government aid by enterprises was a complete farce. Consequently, since then aid to needy enterprises has been cut drastically. But the question remains whether aid to promising companies offers adequate opportunities for supervision.

Who can guarantee that the millions of guilders in aid going to Philips, for example, for the Philips-Siemens project will not also end up in a bottomless pit?

The Ministry of Economic Affairs will provide subsidies for the Megaproject to the tune of 190 million guilders. The German government will pay an additional DM 300 million.

In any case, the aid allocated recently by the Ministry of Economic Affairs is tied to a number of stringent conditions. Philips and Siemens had to agree to independent outside experts (three experts from the FRG and one from the Netherlands) having access at all times to all relevant data.

In addition, both corporations must report every 6 months on the progress of the project, which will take 5 years. These biannual reports will be explained in the presence of officials from the Ministry of Economic Affairs and from the Federal Ministry for Research and Technology.

Next, the outside experts, united in an advisory committee, will write an opinion based on the report and the explanation.

This opinion will include an assessment for the benefit of the subsidy providers. The outside experts will check, among other things, whether the project is going according to plan and whether the project still meets the set requirements. Changes must be reported immediately to the subsidy providers. Subsidies are granted only after discussion of proofs of payment.

Thus the governments hand over the money only after both corporations themselves have spent money for the project. The level of the amount of the subsidy is determined on the basis of subsidy norms. Thus, in the Netherlands, for example, research for a new product or a new production process is eligible for a subsidy up to a maximum of 45 percent.

The whole project usually consists of a number of subsidizable project components which, in this case, produce a total amount of 190 million guilders. In

the Ministry of Economic Affairs budget this total amount is then confirmed for 5 years on the relevant budget items.

Before allocation of the subsidy by the Ministry of Economic Affairs, comprehensive consultations are held with the company involved about the technical and financial chances of the project.

The Ministry of Economic Affairs subsidizes such projects because the risk is great in relation to the certainties which may be established. As a matter of fact, banks are often hesitant about financing research projects.

Overall, the Ministry of Economic Affairs supports promising projects in three possible categories, specifically research, development and concrete investment.

In addition, a company can also lay claim to the so-called "instir-subsidies" (subsidies on labor costs for the benefit of research) and WIR [Investment Account Bill] subsidies (investment subsidies). If the companies involved fail in any way, the Ministry of Economic Affairs can reclaim the money already provided and cancel the remaining allocated subsidies.

Siemens and Philips have to state their agreement with this possible sanction beforehand.

Technical Challenges of Project

Rotterdam NRC HANDELSBLAD in Dutch Supplement 7 Nov 84 p 4

[Article by Wubbo Tempel: "The Shrinking Process Simply Continues"; passages enclosed in slantlines, printed in italics]

> [Text] The problems of chip technology will be eliminated only by the end of the century.

The chip structures are becoming increasingly smaller and more refined; the memory capacity is expanding gigantically. This has been going on with steady regularity since 1960 when for the first time an electronic circuit was made out of a small chip of silicon. Every 3 to 4 years has seen the advent of a new generation of chips with a memory capacity that was four times greater.

This trend will also continue in the future, according to expectations at Philips. At least until the end of the century. As far as that goes, the megabit chip which Philips and Siemens plan to market around 1990, will only be a step then in that lengthy process.

But from another point of view, the megabit chip -- with more than a million static memory elements -- represents a much more important development. Because the limits of conventional technology have been pretty much reached. The chip manufacturers have reached the end of their traditional knowledge and will have to take different roads.

Up to now, a reduction of the chip could be achieved through improvements in existing techniques, in existing equipment and materials. Thus, chips with ever more refined structures followed one another. The memory capacity also kept going up because the more refined the structure, the more tiny elemnts could be fitted on the chip surface.

In this respect, how far IC manufacturers have gotten with the technical development is often expressed in the number of memory elements on a /static/ memory chip. Unlike its dynamic counterpart, the static chip can store information permanently.

It is true that this requires roughly four times as many transistors. Hence for a given memory capacity for the static chip, the dynamic chip goes already four times farther. A source for a great deal of confusion of terminology.

Expressed in static memory terms, the single kilobit chip, with 1024 memory elements, reached its peak in 1978. The four kilobit (4K) reached its peak in 1982. The 16K will be at the top around 1985, and it is expected that the 64K chip introduced last year will reach its high point around 1988.

Even for the 256K static chip, which is expected to be marketed around 1987 and will experience its high point by 1991, the chip manufacturers can still manage with conventional techniques. Dr K. Bulthuis, director of the Philips Physical Laboratory, called the development of the 256K "extremely predictable" and said that no major breakthroughs are needed. "The shrinking process is simply continuing."

According to Bulthuis, in order to manufacture the 1 megabit (1024K) chip next, revolutionary steps will be required. Because the smallest characteristic dimensions of the chips being produced now are about 2 microns -- 2 thousandths of a millimeter --, and they have to be reduced to 0.7 microns for the megachip. For the sake of comparison: a human hair has a thickness of 75 microns.

Limitations

In taking the step from 2 to 0.7 microns the chip makers are encountering the limitations of current technology. In this respect, the method with which the chip pattern is applied by exposure is not even the greatest problem, even though Bulthuis feels that some "optical headstands" will be needed.

Something that will have to be changed fundamentally is the etching away of the exposed lacquer film on the chip. Up to now this was done with liquids, but that is too inexact for the desired dimensions involved in the megachip. They will now be using gasses.

Barriers will also have to be conquered in terms of laying the insulator and conductor layers. As far as the insulators are concerned, they have become so thin -- down to the thickness of only a few atoms -- that their structure is extremely sensitive. Therefore they are looking for new insulation techniques.

In terms of the conductors, miniaturization has comparable effects. Because the conductive strip becomes very thin, the resistance increases. In order to achieve the desired conductivity, new materials will have to be found. Therefore Philips and Siemens are looking into metal silicides which are very good at conducting current. A great deal of research into these materials is still needed.

In a general sense the very small dimensions also cause problems now that one ends up in the order of the size of atoms. A single lost electron can suddenly do a lot more damage than before. Not to mention specks of dust.

Five Years

Philips and Siemens are giving themselves 5 years to conquer those technological barriers. By the middle of 1989 the chip must go into production. By then Siemens will have the 0.4 megabit dynamic memory chip and Philips the 1 megabit static chip. And to explain what it is all good for: the Siemens chip will then be able to contain 16 pages of newspaper text.

Those two companies will probably not be unique by then. None of the many large electronics corporations can afford to lag behind. But, said engineer C. Krijgsman, director of the Philips chip division: "At that time Philips will be nicely in step with the major competitors. Perhaps we will not be the first, but we will certainly be competing with the front lines." Professor J. Middelhoek, member of the Supervisory Committee appointed by the Ministry of Economic Affairs, confirmed this statement. According to experts none of the manufacturers will be able to produce the chip before the late eighties. And what is already being shown now in terms of megachips is dynamic chips which cannot yet be manufactured on a commercial scale.

Finally, a layman would think that at one point it will all come to an end. But Bulthuis said cheerfully: "The end is not yet in sight." There is a question though, according to him, of whether dimensions below half a micron can be achieved with the traditional exposure technique. But then they can shift to X-rays or electron or ion bundles to apply the pattern to the chip.

Bulthuis said about this: "There is no physical reason at all not to continue to 0.1 micron. Hence we are going to continue at least until the end of the century."

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MICROELECTRONICS

RENAULT OF FRANCE TO MAKE LIQUID CRYSTAL DISPLAYS

Paris AFP SCIENCES in French 18 Oct 84 p 60

[Article: "Renault Is Starting to Manufacture Liquid Crystal Displays"]

[Text] Aix-les-Bains--The French-Japanese manufacturer of liquid crystal displays IDESS [Information Display Electronic System], which was officially created on 12 October, should soon enable Renault to become a leading manufacturer in this field. The management of Renault Industrial Enterprises (REI) which, in agreement with its Japanese partner Stanley, decided to set up a first production unit at Bourget-du-Lac (Savoy) held a press conference to present its project on 16 October in Aix-les-Bains. Liquid crystal displays are one of Renault's three data-processing projects, the other two being ceramics in Tarbes and electronic sensors in Lorraine. Eventually, each of these divisions should account for 1,500 to 2,000 jobs.

IDESS is a partnership between Renault (45 percent), Stanley (31 percent), Jaeger (19 percent) and the Dreyfus Bank (5 percent). According to Mr Henri Streit, manager of REI, the choice of Stanley (which is already collaborating on the electronic "R11") is explained by the fact that this company (2,000 employees and sales of FF 4 billion) was the first one to develop large-size liquid crystal displays (30 x 15 cm), which should enable it to tackle first the transport market, then telecommunications, the navy, aviation, arms and, finally, household appliances and microcomputers. Actually, this technology can be used in any data-processing system and should ultimately replace CRT screens.

According to Mr Streit, "these are considerable future markets and the supply is quite inadequate. If all goes well at the Bourget plant, we shall soon create a second one to process larger screens." "With liquid crystal displays replacing cathode tubes," Mr Streit concluded, this could be the exploding market of the decade."

The first plant of IDESS (Information Display Electronic System, the word IDESS meaning "very good" in Japanese) will be operational late in 1985; it will be built on the site of the former Bourget air base. It will employ 200 highly-skilled workers and create 150 jobs at subcontractors'. The size of the investment required--FF 234 million--is due to the refinement of the process which is carried out in "white rooms" that are 10 times more aseptic than operating rooms.

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MICROELECTRONICS

BERLIN: NEW SIEMENS PLANT FOR FIBER-OPTICS COMPONENTS

Duesseldorf HANDELSBLATT in German 9/10 Nov 84 p 16

[Article: "New High-Tech Factory to be Built in Berlin"]

[Text] With an investment of over DM 200 million, Siemens AG will build a factory to manufacture fiber-optics components and film circuits at its Berlin location.

DM 115 million will be invested during the first expansion phase and a like amount in the mid 1990s. A total of 600 new jobs will be created. Also, DM 20 million will be spent to expand the present film-circuit factory in Munich. With this project, Siemens aims to strengthen its international position in the field of fiber-optics technology. At the beginning of the 1990s, the world market for these components is projected to be DM 3.5 billion. Presently this market is expanding at the rate of about 35 percent per year; and, in spite of increasing market maturity, the estimated annual growth rate will still be about 20 percent in the 1990s.

When asked, Siemens reported that there are no concrete plans concerning a glass fiber factory in Berlin following the colllapse of the joint project with SEL, Philips, AEG and Kabelmetal after a veto by the Federal Cartel Office. Via Siecor Optical Cable, a joint subsidiary of Siemens and Corning Glass, Siemens already has access to glass fiber production know how. Siecor is the second largest manufacturer of glass fiber cables in the United States. There, 200,000 km of fiber cable was produced between September 30, 1983 and September 30,1984. In Munich, Siemens also produces glass fiber cable, but in smaller quantities.

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MICROELECTRONICS

BRIEFS

CNET LIQUID CRYSTAL RESEARCH--The current project of the Lannion-B Center is to attempt to go beyond the present limitations of liquid crystal displays and achieve levels of complexity compatible with the Minitel service; the object of the project is to develop a flat-screen Minitel terminal associating an active matrix of thin-layers of transistors to twisted nematic liquid crystals. The flat-screen macrocomponent consists of three subassemblies: the active matrix, the liquid crystal cell and the eletronic peripherals. Michel Le Contellec, was appointed head of the CLEMATITE project (liquid crystals and active matrix in integrated technology for display terminals). The greatest difficulty, but also the originality of the project, has to do with the development of a thin-layer transistor matrix. A technology of amorphous silicon transistors on a glass substrate, which is transparent and inexpensive, was developed. The problem, therefore, boils down to developing a complex integrated circuit consisting of as many transistors as there are pixels (some 10^5), the latter being distributed over an area greater than or equal to 1 dm^2. To-date, complete displays made up of 320 rows and 320 columns at a pitch of 4 pixels/mm have been made and tested. These displays ally suitably oriented twisted nematic liquid crystals to the transistor matrix; the interface between the Minitel terminal or a TV video signal and the flat screen is provided by discrete-components electronic peripherals. Note that the first assessments show that such a screen will provide strongly contrasted pictures (the pixel remaining excited as long as the picture lasts) with a gray scale, and it will do so for low control voltages (below 15 V) compatible with the future use of low-cost CMOS [complementary metal-oxide semiconductor] peripheral integrated circuits. However, the displays that have already been validated present a number of defects--interrupted rows or columns, non-excited pixels, etc.--that will have to be analyzed and corrected. The second phase of the project consists in producing a larger (6-inch diagonal) screen suitable for the Minitel structure: 25 lines of 40 characters, i.e. 320 x 250 pixels. In addition, the technology of implementation of liquid crystals will have to be improved and the possible use of hybrid integrated circuits at the periphery of the display will have to be assessed. [Text] [Issy-les-Moulineaux L'ECHO DES RECHERCHES in French No 116, 2nd quarter 1984 pp 80-81] 9294

CSO: 3698/198

SCIENCE AND INDUSTRIAL POLICY

BUDGET FOR SWEDEN'S DIRECTORATE FOR TECHNOLOGY DEVELOPMENT

Stockholm TEKNIK I TIDEN in Swedish No 4, 1984 p 27

[Text] In the spring of 1984 the state authorities reached a decision on the STU [Technical Development Board] budget for the 3-year period 1984-87. The decision means that STU will have limited resources compared with the previous 3-year period.

By means of extensive reallocations of resources STU will increase spending on the following in 1985-86:

Engineering technology: This is an area that is especially important for the renewal and long-range competitiveness in large sectors of Swedish industry.

Biotechnology: This is an area in which a new industry is emerging across a broad front and in which Sweden has especially great possibilities of making a mark from the very beginning.

STU will also spend more on:

Young business based on technology. Such businesses have a very high growth potential.

STU has also been directed to set up a technical research council function. This will deal with especially outstanding technical research.

Information Technology in New Program

STU intends to continue to make big investments in the area of information technology, i.e. electronics and computer technology. In October STU has also been directed by the state authorities to present in conjunction with other bodies a proposal for a national information technology program. The offensive investments that will be proposed in this program are not entirely included in the STU budget.

The consequence of these increased investments is an inevitable reduction in other areas. Naturally there is great disappointment among research institutions and businesses that enthusiastically and wholeheartedly assisted

STU in preparing the proposal for research and development funding. For example STU is cutting funding in the areas of materials technology and forestry.

In its proposal STU pointed out to the authorities that it did not have sufficient resources to carry out all the activities STU is expected to carry out.

Extra Money for Product Development

In order to fulfill the high ambitions the state authorities have expressed for STU to some extent, STU has proposed a limited increase in resources. That would allow a restoration of support for qualified product development projects for individual inventors and small firms and in addition a number of strategic research and development programs for Swedish industry could be implemented, in the area of materials technology among others. These investments would require around 50 million kronor and would be a very profitable investment in the future.

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TECHNOLOGY TRANSFER

FRG, FINLAND COOPERATION IN MINING, METALLURGY

Duesseldorf HANDELSBLATT in German 9/10 Nov 84 p B5

[Article by Joachim Krueger*:"Cooperation with Helsinki Technical University Strenghtened: Focal Point Metallurgy and Mining"]

[Text] HANDELSBLATT--TL, 8 Nov 1984. The Technical Universities of Helsinki and Aachen intend to work more closely together in the future. A recently concluded agreement focuses on the disciplines of metallurgy and mining.

On August 22, 1984 a cooperative agreement between Helsinki Technical University and the RWTH Aachen was ratified during the second status seminar in accordance with the German-Finnish Cultural Agreement of 1978. This cooperative agreement will solidify and deepen an existing multiyear joint effort of the two technical universities.

This joint effort and the agreement relate in particular to the areas of mining and metallurgy which represent industrial branches having equal importance in both countries. The cooperative effort provides for the short term exchange of university students and scientific collaborators. In the foreground of this joint effort are the introduction and execution of common research work and the exchange of information in research and education in areas of mutual interest. Through this cooperative effort, duplication will be reduced to a minimum at both locations, conserving both time and money.

It is of value for the technical universities in Helsinki and Aachen to meaningfully up-grade in the area of metallurgy. In Helsinki basic research will be stressed; in Aachen applied research will play a greater role.

Younger scientific associates--also, very soon students--of both universities will have to spend 3 months to a year at the exchange university to gain experience in a special field at the partner university and also to bring one's own information to the work being done there. The first dissertation work to grow out of this joint effort has already been completed in Aachen and Helsinki; the doctorial advisors always stem from Aachen and Helsinki. There is no language barrier; German and English are the common languages.

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Examples clarify the type of cooperative effort: In Aachen and Helsinki work is underway on a refining process for the rapid removal of arsenic and antimony from copper melts. In Helsinki basic research is determining the arsenic-antimony distribution in copper and slag as a function of oxygen potential and temperature. In Aachen a ladle refining process has been developed and successfully tested on a 600-kg scale. By using the theoretical distribution data (Helsinki) it was possible to largely remove the arsenic and antimony in about one minute (Aachen). This process proposal is of equal interest to the copper industries of both countries, especailly for processing what is referred to as complex concentrates.

In both countries effort is being expended on the development of new lead extraction processes (Kivcet, Outokumpu, QSL). Thus it makes sense to undertake basic supporting work on the behavior of metallic contaminants and impurities at both technical universities. In Aachen and Helsinki, the distribution of these elements to lead and slag at clearly different oxygen potentials (in the reaction and reduction areas) is being studied.

Work on problems related to blast-furnace extraction of iron has begun jointly in Aachen and Helsinki. The latest work (a dissertation) dealt with the alkali cycle in the blast furnace and particularly in the cohesive zone associated with melting of the slag and iron. The problems occuring here are of equal importance for the research groups of both technical universities and can be solved quicker and cheaper by using special equipment and by drawing on the experience of the professors of both universities.

In Aachen the gasification of coal is an important research field associated with ferrous metallurgy. Experience in the gasification of hard coal and lignite is available. The Finnish partners were interested in including their domestic peat in such studies. The basic research on this was begun in Aachen; in Helsinki, the objective was advanced and accepted to gasify Finnish peat so that smaller energy generating stations which use domestic fuels can be built for outlying regions.

Here it has been shown by example how one such joint venture works. Of course such joint efforts require common goals and interests; the joint effort works only when the partners are friends and understand one another. That is the case here.

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TECHNOLOGY TRANSFER

FRG ECONOMICS INSTITUTE CRITICIZES COCOM LIST

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 15 Nov 84 p 13

[Article: "Institute Criticizes Cocom List: The Flow of Goods between East and West is growing Thinner"]

[Text] ls. Berlin, 14 November. "The West European countries must attempt to establish their viewpoint in Cocom through better and more forceful arguments. It must be made clear to the representatives of the United States that in the long run further expansion of the controls not only endangers East-West cooperation but also West-West cooperation. "With greater emphasis than before, the German Institute for Economic Research (DIW) criticized in its most recent analysis of Eastern trade the list of goods prohibited for exportation to CEMA countries. Included are goods whose use could be harmful to Western interests. Viewed by the Berlin institute as bases for criticism are, first, this summer's lengthening of the tabu list and the new practice of not granting exceptions and, second, the East-Block countries' increasing sensitivity on the question of economic dependence since sanctions were imposed on the Soviet Union and Poland. In the opinion of DIW, both of these have led to the situation wherein the development of goods exchange between the Eastern and Western power domains has become uncertain.

And just as the credit worthiness of the CEMA countries has again started to increase, the purely economic boundary conditions for a closer trade involvement have worsened. The DIW cites in particular the fact that in the future the Soviet Union can not achieve an increase in its balances through the export of energy raw materials. Thus, the former growth engine of Soviet western trade has stalled out. Devleopment is also limited by the fact that the goods offering of the East Block countries still does not meet Western expectations over a wide spectrum. Evidence of this export weakness is the small quantity of machinery in deliveries from the CEMA countries. Against this backdrop, it would be considered a success if trade betweeeen the OECD and CEMA countries could retain a current level of 4.8 percent of world exports.

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